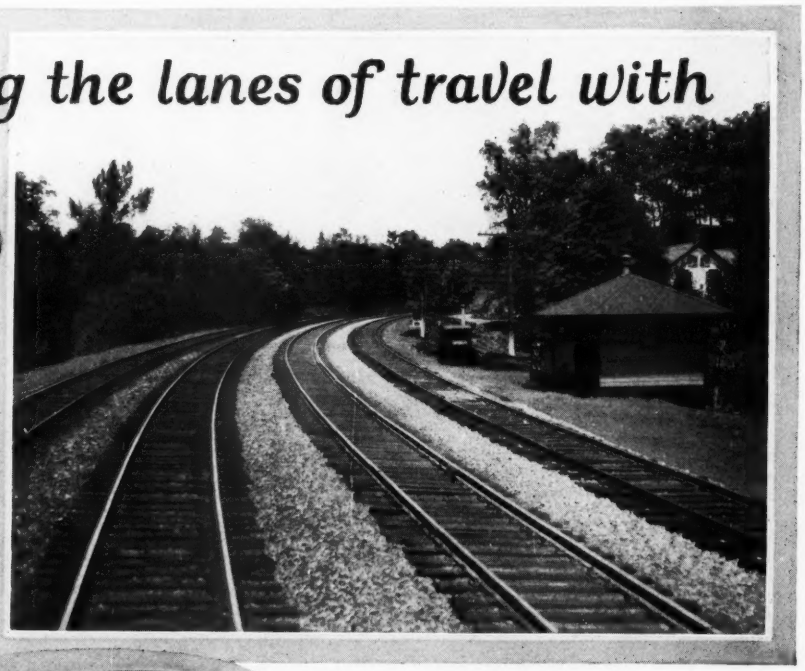
JANUARY, 1926

Railway Engineering and Maintenance

CHICAGO THE P. & M. CO. NEW YORK
MONTREAL LONDON PARIS CALCUTTA SYDNEY

Safeguarding the lanes of travel with



HY-CROME

HY-CROME rail joint security is safe because it's permanent.

It's permanent because of excess gripping power due to unbreakable non-fatiguing qualities found only in Hy-Crome.

Unlike ordinary nut locks, Hy-Crome rail joint rigidity never relaxes—such performance is the only kind of nut lock economy that substantially lowers track maintenance and keeps it there.

THE RELIANCE MFG. CO.
MASSILLON, OHIO
NEW YORK CLEVELAND DETROIT
CHICAGO ST. LOUIS SAN FRANCISCO
Engineering Materials, Ltd., McGill Bldg., Montreal, Quebec, Canada
N. S. Kenney, Munsey Bldg., Baltimore, Md.

RAILWAY ENGINEERING AND MAINTENANCE
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Alphabetical Index to Advertisers, Page 50 Classified Index to Advertisers, Pages 48-50

LOWER COST PER CAR PER MILE

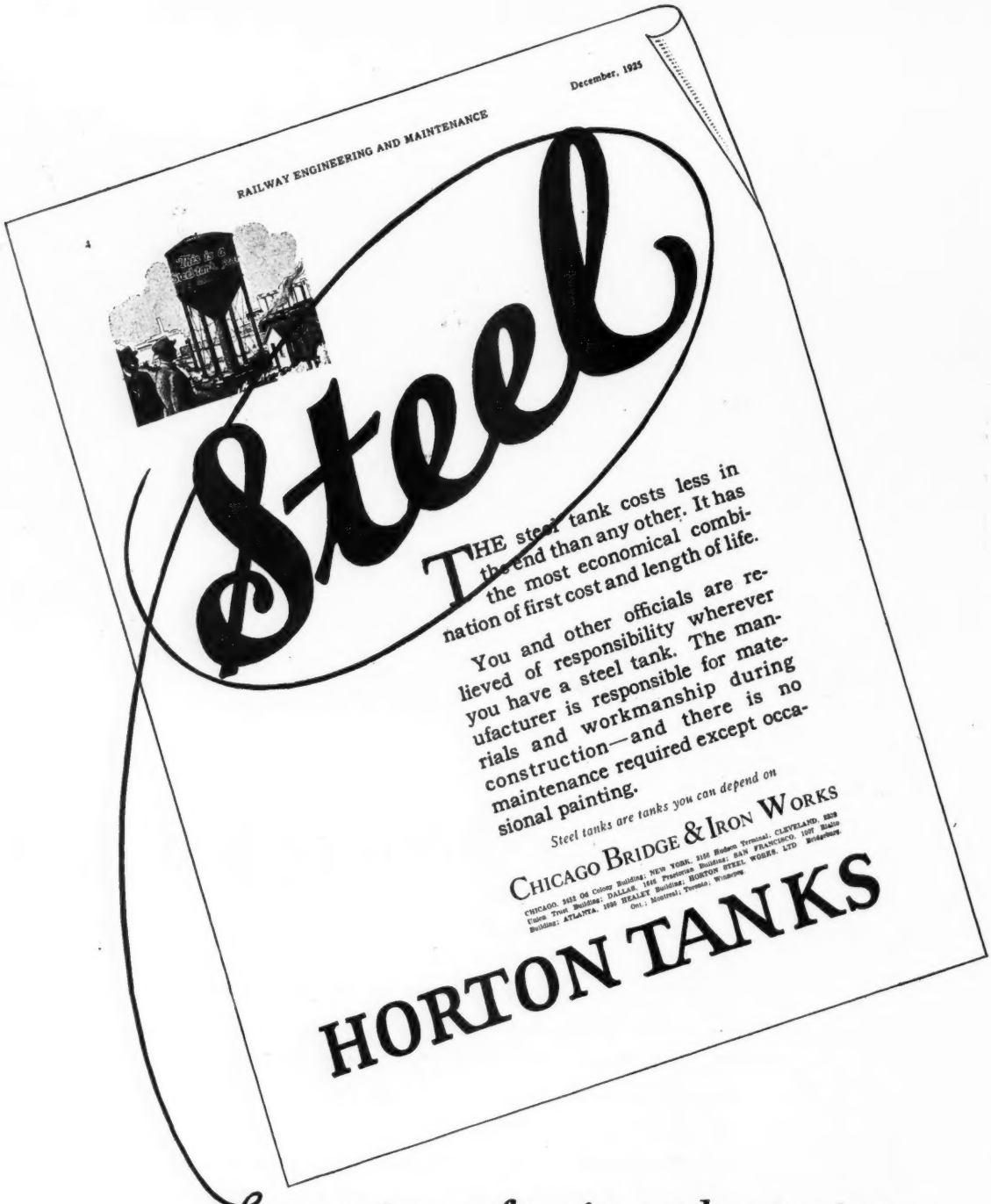
Through America's snow tipped peaks

OUT in the Rockies! Heavy loads of men or materials, up long, stiff grades. Severe curves that make the going harder. And strong headwinds, mixed in with frequent bad weather, making the job still tougher for man or motor car. ¶ There you will find Mudge motor cars—real thoroughbreds—hitting the ball day in and day out. You'll find them all over the world. They're built to do a hard, steady job wherever there is a railroad track.

Mudge & Company

Manufacturers—Railroad Equipment
Railway Exchange Bldg. : Chicago

A MOTOR CAR FOR EVERY SERVICE



for water softening plants, too—

A conical-bottom tank and the proper chemical apparatus have proven to be a successful ground operated softening plant. The shape of the bottom is particularly favorable to the chemical action and settling phases of water softening.

It's just another advantage to appreciate when buying a tank for a water softening plant. The conical-bottom accumulates all sludge in a small area at the bottom of the riser. From there it is easily blown out with a *small* quantity of water.

We install ground operated softening plants complete with conical-bottom tank and chemical equipment.

A-30

An Unusually Attractive Local Station Layout

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

Volume 22 January, 1926 Number 1

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WOULD YOU LIKE TO KNOW

A method for preventing the drying of concrete while it is hardening?

How one road has practically eliminated low joints?

The relative life of untreated white oak ties as compared with treated ties of other woods?

How one road tests the capacity of its deep wells?

The railway outlook for 1926?

Answers to these and other questions will be found in this issue.

ELMER T. HOWSON, *Editor*
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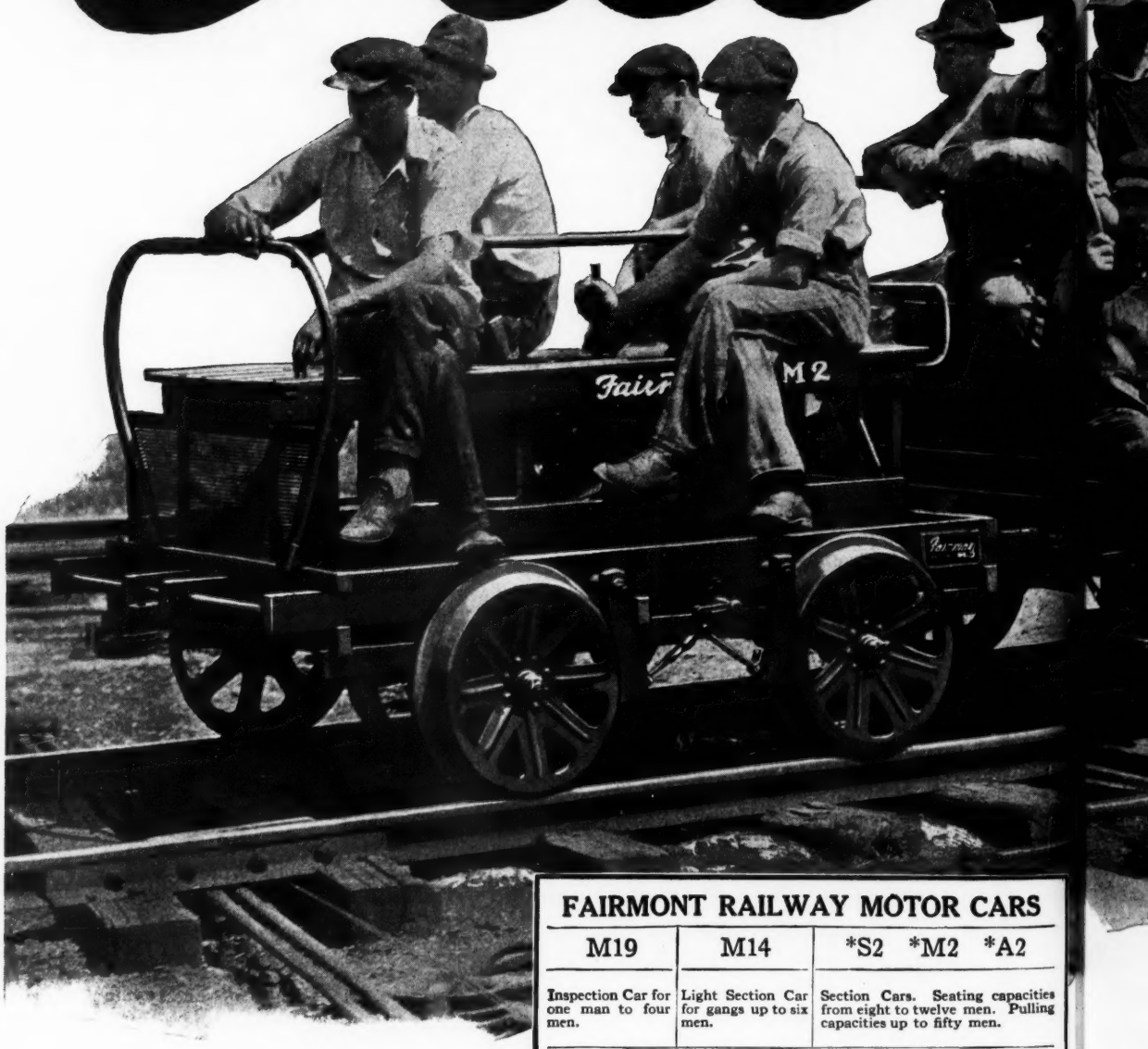
Fair



FAIRMONT RAILWAY MOTOR CARS

M19	M14	*S2 *M2 *A2
Inspection Car for one man to four men.	Light Section Car for gangs up to six men.	Section Cars. Seating capacities from eight to twelve men. Pulling capacities up to fifty men.

*ST2 — MT2 — and AT2 are corresponding models equipped with 2 speed transmission for extra heavy pulling.

FOR THE TWELFTH CONSECUTIVE YEAR OVHAL

mont

CONFIDENCE
based upon
PERFORMANCE

More than half of the motor cars purchased each year are Fairmonts.

The overwhelming preference for these sturdy cars is the result of outstanding performance on the job.

The cost records of thousands of motor cars offer indisputable evidence of Fairmont's greater economy. Comparative tests under the most severe conditions have proven their greater safety and reliability time after time.

Designed by pioneers in the industry, Fairmonts represent the latest developments in motor car construction. Their workmanship is consistently superior; and their prices—most reasonable.

FAIRMONT RAILWAY MOTORS, Inc.
FAIRMONT, MINNESOTA

DISTRICT SALES OFFICES:
New York Chicago St. Louis San Francisco
Washington, D. C. Winnipeg, Canada

HALF THE CARS PURCHASED ARE FAIRMONTS

Jacking ARMCO without tying

Improved methods save 1/3 to 3/4 usual costs

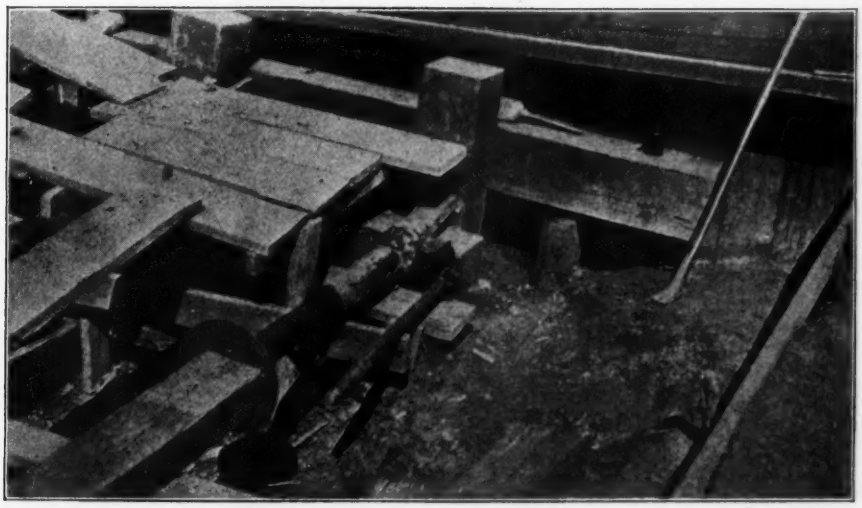
NO TORN up pavement, no interruption to traffic, no softened fills with broken slabs, no shoring and absolute safety—these are a few of the advantages of the improved methods of jacking Armco Pipe under heavy fills.

Armco Engineers have simplified this method until ordinary labor can do the work with a few simple tools. It is being used on both railways and highways with complete success—to replace failed culverts as well as to correct inadequate drainage facilities.

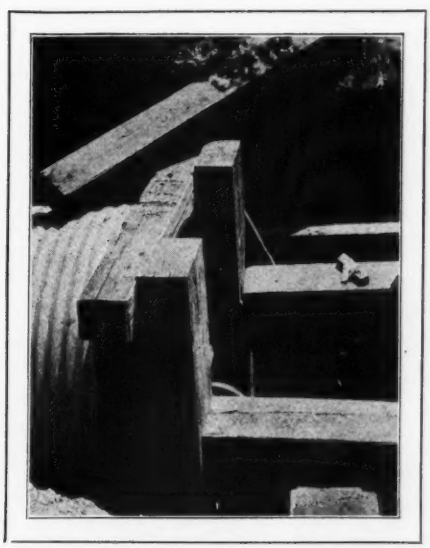
These heavier culverts of 8-gauge metal, exclusive with Armco, are almost ¼ in. thick. They have ample strength in sizes up to 84 in. for highway superloads—ample strength to withstand jacking through the heaviest fills.

Write for free bulletin

Culverts *through fills*
up traffic



Only ARMCO Can Give You—

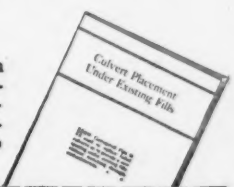


Positive safety factors for large size pipe based on new and reliable tests; the opinions of engineers who have used this method with success; names of contractors who will bid on these jobs and use Armco methods, or the help of an experienced Engineer who will assist your men. And only Armco can give you pipe of the purest iron made, a metal that has proved itself in every major test to be best adapted to culvert service.

ARMCO CULVERT & FLUME MFRS. ASS'N.
Middletown, Ohio

Write for Bulletin

Mail the coupon for a free bulletin describing Armco methods, showing illustrations of installations, giving approximate savings for both highways and railways using this installation process. No obligation.



Get cost estimates

ARMCO CULVERT & FLUME MFRS. ASSN.
Middletown, Ohio

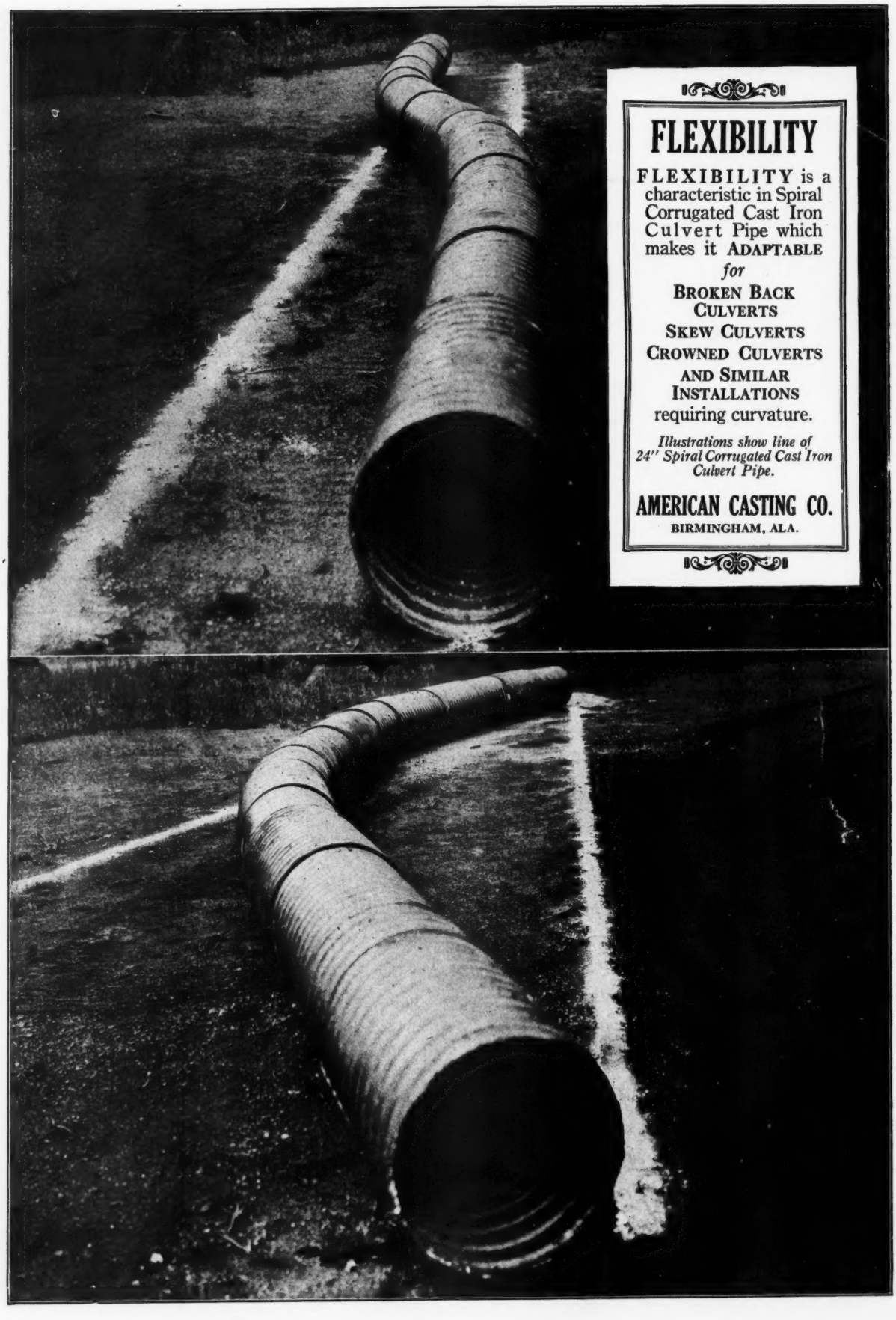
Gentlemen: Please send me a copy of your bulletin, "Jacking Armco Pipe Through Fills," with examples of the economies gained by engineers who are using this method.

Name.....

Name of Road.....

Address.....

City..... State.....


FLEXIBILITY
FLEXIBILITY is a characteristic in Spiral Corrugated Cast Iron Culvert Pipe which makes it ADAPTABLE
for
BROKEN BACK CULVERTS
SKEW CULVERTS
CROWNED CULVERTS
AND SIMILAR INSTALLATIONS
requiring curvature.
Illustrations show line of 24" Spiral Corrugated Cast Iron Culvert Pipe.
AMERICAN CASTING CO.
BIRMINGHAM, ALA.

Smooth Riding Track

SMOOTH riding track is impossible where bunched rail expansion takes place; and bunched rail expansion always results from improper tightening of joint bolts.

When bolts are generally too tight, it is not possible for the rails to expand normally and individually. Thus more than normal expansion takes place at the first loose joint. This causes the track to hump and buckle with resulting rough riding and discomfort to passengers.

Verona Rail Joint Springs are the best possible safeguard against bunched rail expansion. By their use, uniformly tight bolts can be obtained. But even in the event of over tightening, Verona Rail Joint Springs permit normal expansion of the rails. Their enormous reactive pressure is exerted in the direction of the bolts, but not in the direction of the rails. They compensate for bolt stretch, rust, and wear, and keep the bolts perpetually tight, yet they do not interfere with the necessary and normal expansion of the rails.

Read the Verona advertisement on the opposite side of this insert and also the one on the back cover.

VERONA TOOL WORKS Pittsburgh, New York, Chicago, Boston, St. Louis, San Francisco New Orleans, Washington, St. Paul, Denver, Baltimore

Point for Point

Compare this shovel with any in the world

The Top — broad grip for a big hand—smooth, splinterless metal sides—non-splitting birch grip that isn't cold as ice in winter—take-up on the grip rivet to prevent it turning, two take-ups on the rivets that hold the top to the handle—whole top easily replaced so that a broken top does not mean a ruined shovel.

The Handle — XX Grade Northern white ash steam bent with the grain.

The Straps — Note how closely the straps fit the handle, excluding moisture and giving complete support.

The Socket — Handle extends to the very point of the socket. Cut open any Verona shovel and see for yourself. Then cut open any shovel of any other make. Compare the construction at this vital point where 85% of all shovels fail.

The Weld — Note the width of the weld—in excess of half an inch.

The Back — soft annealed carbon steel. It will bend without breaking. That is one reason for its long life. And it can always be bent back into shape and be as good as ever. No rivets.

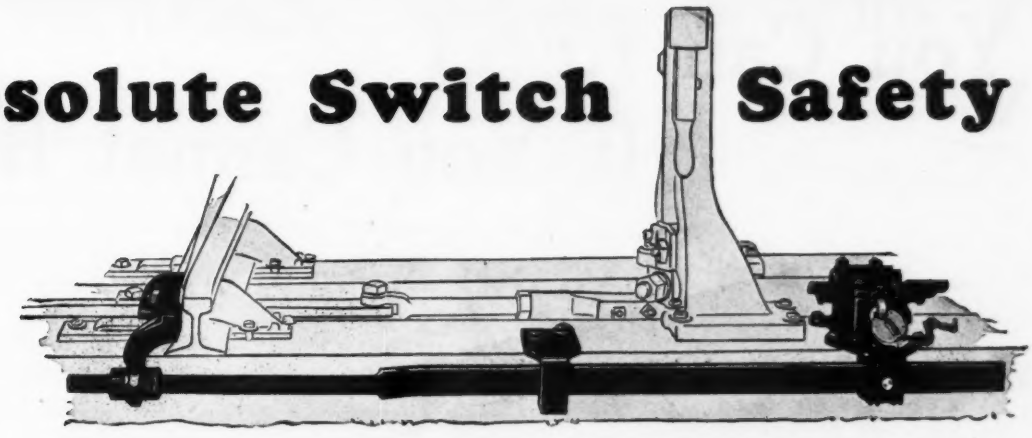
The Edge — hard, tempered, sharp, evenly hammered, straight.

We repeat—point for point, compare this shovel with any in the world.

VERONA TOOL WORKS

Read the advertisement on the preceding page and the one on the back cover.

Absolute Switch Safety



The ANDERSON Switch INTERLOCKER will be on display at the National Railway Appliance Exhibition at the Coliseum, Chicago, March 8th to 11th. Spaces 130, 131, 132, 133.

Write for Bulletin 101 describing the Anderson Switch Interlocker in detail.

The Anderson Switch INTERLOCKER prevents the switch from opening under traffic:

1. Should the switch stand be damaged or destroyed by accident.
2. Should any part of the switch mechanism become disengaged or fail when the switch is closed and locked for the main line.

The switch must be properly closed in order to apply the padlock.

The Interlocking is automatic when the switch is properly closed.

It is not a part of the switch stand—can be applied to any switch and used with any switch stand.

The American Valve & Meter Co., Cincinnati, Ohio, U. S. A.

Exclusive Manufacturers of

THE ANDERSON Switch INTERLOCKER

Branch Offices:

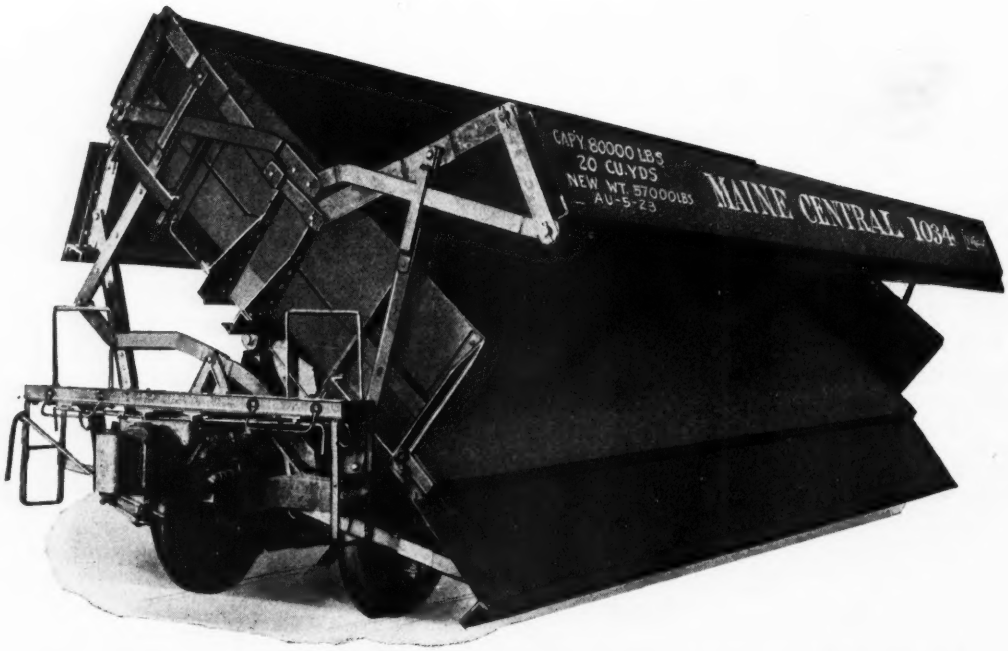
Chicago, Ill., McCormick Bldg. Boston, Mass., Essex Bldg.
St. Louis, Mo., Chemical Bldg. Baltimore, Md., 724 E. Pratt St.
Denver, Colo., Barth Bldg. Richmond, Va., Mutual Bldg.
Roanoke, Va., First Nat. Bank Bldg.

Sole Canadian Representatives:

The General Supply Company of Canada, Ltd.

Ottawa Toronto Montreal Moncton

You Can RENT If You Cannot Buy



Superb for maintenance work—Western Automatic 20-yard Air Dump Car with Apron

Western

That's Why

If your Board will not pass an A. F. E. rent as many Western Air Dump Cars as you need. They will pay for themselves in money saved, compared with old methods. Equipped with aprons for Railroad Use, to throw the load beyond the ballast.

Write today for our rental proposition.

Western Wheeled Scraper Co.

Founded 1877

Earth and Stone Handling Equipment

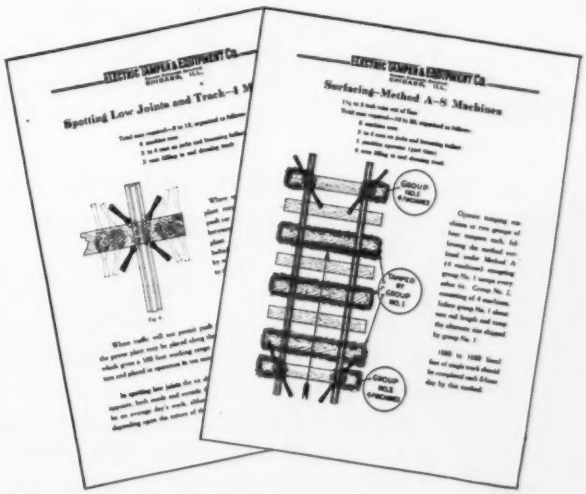
AURORA ILLINOIS

MECHANICAL TAMPING METHODS

We have compiled a number of illustrations and data of the most effective methods of mechanical tamping with suggestions in regard to gang organization, assignment of men to various duties and the amount of work that should be accomplished within a given time.

The methods illustrated are standard practice on representative railways and will be of assistance in obtaining maximum efficiency from your mechanical tamping equipment.

Twelve pages in loose leaf form to fit right in your catalogue on the Jackson Electric Tie Tamper will be sent upon request.



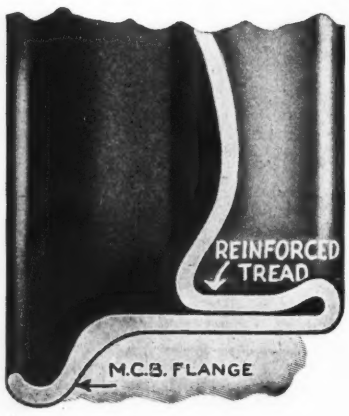
ELECTRIC TAMPER & EQUIPMENT CO.

RAILWAY EXCHANGE
CHICAGO, ILLINOIS

BUDA
ESTABLISHED
1881

Rolled Steel Wheels

(PATENTED)



Greatest Resistance to Wheel Load

STRONG LIGHT DURABLE

Made from Single Plate Special Open Hearth Flange Steel

Compression tests chart the Buda Disc Wheel as 50% stronger than any other rolled (or pressed) steel wheel of the same thickness and weight.

Solid Web or Disc Type

NEW FEATURES

MCB (1 inch) flange turned over to considerable depth for stiffness;

Increased thickness of flange and tread by special rolling process—an exclusive Buda feature;

Smaller holes and deeper corrugations provide greater resistance to vertical and side load;

Hubs tapered on outside to provide perfect fit to machined (not punched) hole in web;

Hubs closely fitted to web corrugations. Eliminates strain on rivets;

Bosses on hubs provide flat seating for rivet heads.

Punched Web Type

REGULAR FEATURES

MCB cone tread insures ease in rounding curves;

DOUBLE TREAD with DIRECT WEB SUPPORT maintains running surface in true circle indefinitely. Insures long life.

NO DENTING OR FLAT SPOTS

Web: Corrugations of unusual depth insure extreme resistance to side and vertical loads.

Hub: Taper pressed fit to machined hole in web. Hot riveted.

Bosses underneath rivet insure tight fit.

No strain on rivets—perfect fit to web corrugations.

BUDA ROLLED STEEL WHEELS are furnished for Railroad Motor Cars, Hand and Push Cars and Velocipede Cars.

THE BUDA COMPANY

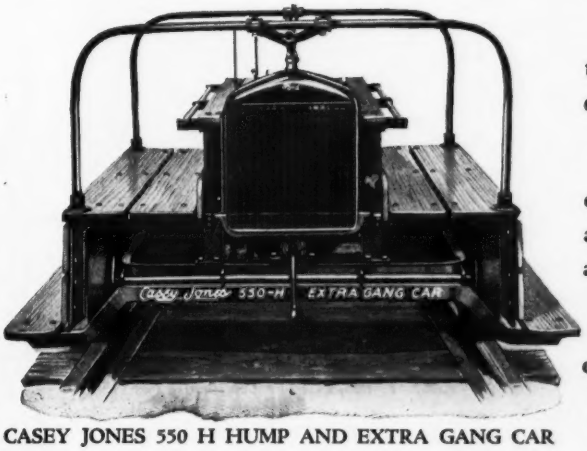
HARVEY (Chicago Suburb) ILLINOIS

30 Church Street NEW YORK | Railway Exchange CHICAGO | Railway Exchange ST. LOUIS | 664 Mission St. SAN FRANCISCO

LONDON

Casey Jones 550

FOR HEAVY DUTY SERVICE—
Dependable FORD MOTOR performance—



CASEY JONES 550 H HUMP AND EXTRA GANG CAR

The Standard Ford Motor has sufficient power to operate the car successfully with the largest crews.

Experienced operators are not required as every one is familiar with its operation. Costly delays are avoided as motor service and parts are available at every Ford service station.

Every user reports such satisfactory service as other motor cars are unable to equal.

WRITE FOR DETAILED INFORMATION

Casey Jones 550 SERIES—FORD MOTOR EQUIPPED

TYPE 550—Standard car with standard seating for 10 men.

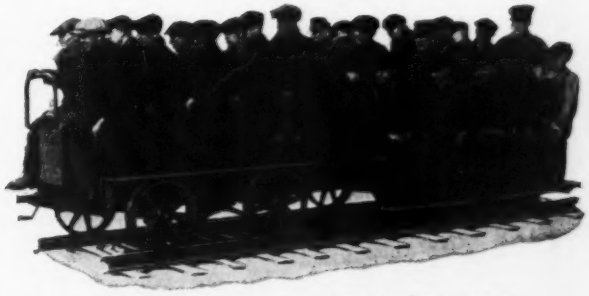
TYPE 550 P—Standard chassis with platform for hauling material.

TYPE 550 T—Standard chassis with enclosed top. Full starting and lighting equipment.

TYPE 550 H—Hump and extra gang car. Seating capacity 20 men.

TYPE 550 EP—Electric Power Car equipped with 7½ K. W. generator for operating electric tampers, saws, track drills, flood lights and other electric driven track tools.

Specify Casey Jones
An investment in permanent satisfaction



PLENTY OF POWER FOR LARGE GANGS

REGIONAL BRANCH OFFICES

WASHINGTON, D.C.	W. NEWTON JEFFRESS, INC. EASTERN EXECUTIVE 1319 F STREET N. W.
NEW YORK	SHAFFNER & ALLEN 50 CHURCH STREET
CHICAGO	OTIS B. DUNCAN 53 W. JACKSON BOULEVARD
BIRMINGHAM	A. A. CULP 239 BROWN-MARX BLDG.
ST. LOUIS	WM. J. ROEHL RAILWAY EXCHANGE
ST. PAUL	RANK & GOODELL 906 MERCHANTS BANK BLDG.
SAN FRANCISCO	W. H. WORDEN CO. 126 PINE STREET
PORTLAND	WESTERN RAILWAY SUPPLY CO. 15th & JOHNSON STS.
FOREIGN	Koppel Industrial Car & Equip. Co. KOPPEL PA. EXCLUSIVE EXPORT AGENTS

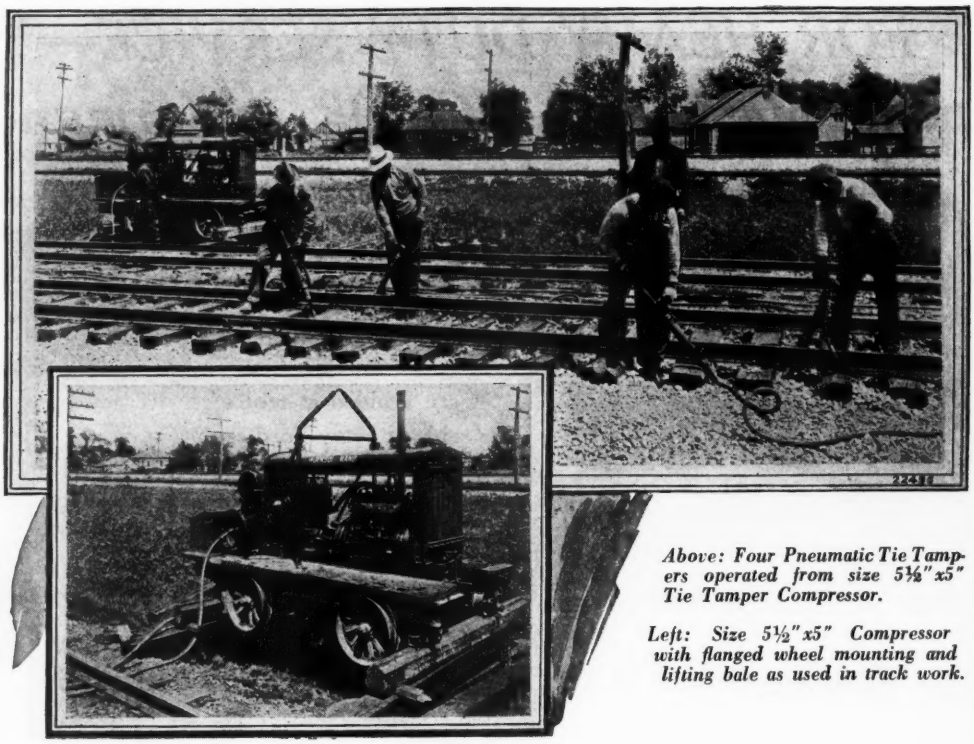
NORTHWESTERN MOTOR COMPANY

FACTORY and GENERAL OFFICE — EAU CLAIRE, WIS., U. S. A.

Casey Jones

MANUFACTURERS—RAILWAY MOTOR CARS

PNEUMATIC TIE TAMPING



Above: Four Pneumatic Tie Tampers operated from size 5½"x5" Tie Tamper Compressor.

Left: Size 5½"x5" Compressor with flanged wheel mounting and lifting bale as used in track work.

The most economical way to make good track

Ingersoll-Rand Pneumatic Tamping outfits not only speed up the tamping but produce a more even and uniformly tamped track which stands up twice as long as that tamped by hand.

One road reports "It has been definitely proved that four men with pneumatic tampers will tamp more track per day and do a better job than 12 to 16 men using hand picks and bars. With the untiring power of compressed air, a firm and solid bedding is secured which other tamping cannot equal."

Descriptive Bulletins sent on request

INGERSOLL-RAND COMPANY—11 BROADWAY, NEW YORK CITY

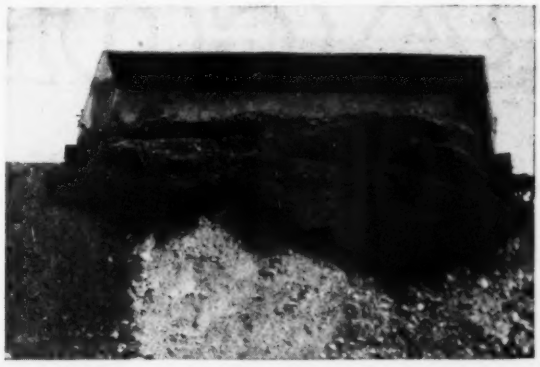
Offices in principal cities the world over

FOR CANADA REFER—CANADIAN INGERSOLL-RAND CO. LIMITED, 260 ST. JAMES STREET, MONTREAL QUEBEC

221-TT

Ingersoll-Rand

Dumps quickly and surely but without destructive shock. Keeps the ballast clean by dumping so far from the track. The line drawing at the bottom of the page shows how this is done and how the low height and stability is obtained.



Dumps to either side by simply moving lever in the desired direction of dumping.

No chance for accidental dumping.

Differential Air Dump Cars

Dump further from the track.

Tilt to a steeper angle insuring clean dumping of all classes of material.

Dump quickly and surely to either side without changing any mechanism.

Are inherently stable. Cars ride on four points directly over bolster side bearings.

Are lower and easier to load.

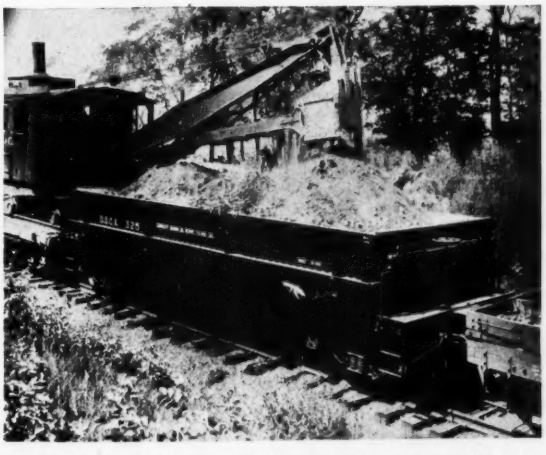
Have a smooth floor and clear discharge opening. All sizes of material easily dumped.

Have no locking mechanism to get out of order.

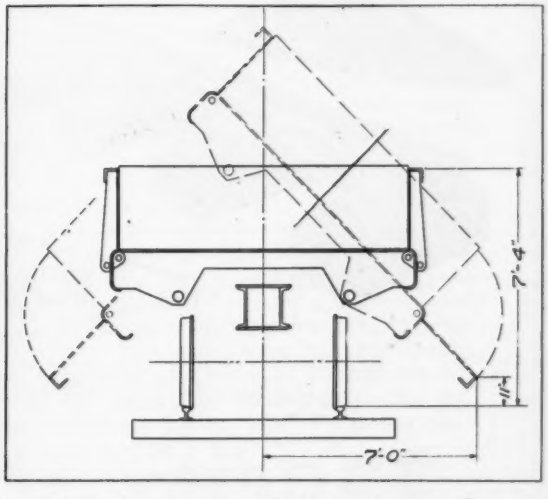
Are perfectly safe. Cannot dump accidentally.

Have a floor construction which enables them to stand up under the most cruel treatment such as heavy boulders being dropped into car.

Are extremely simple. Have fewer working parts.



This car is being loaded full length with standard ditcher. Capacity, level full, 24 cu. yds., crown loading, 36 cu. yards.



Dumping about trunnions located over gage line on dumping side instead of center line trunnions give stability and extra distance of discharged load from track.

THE DIFFERENTIAL STEEL CAR CO.

FINDLAY OHIO

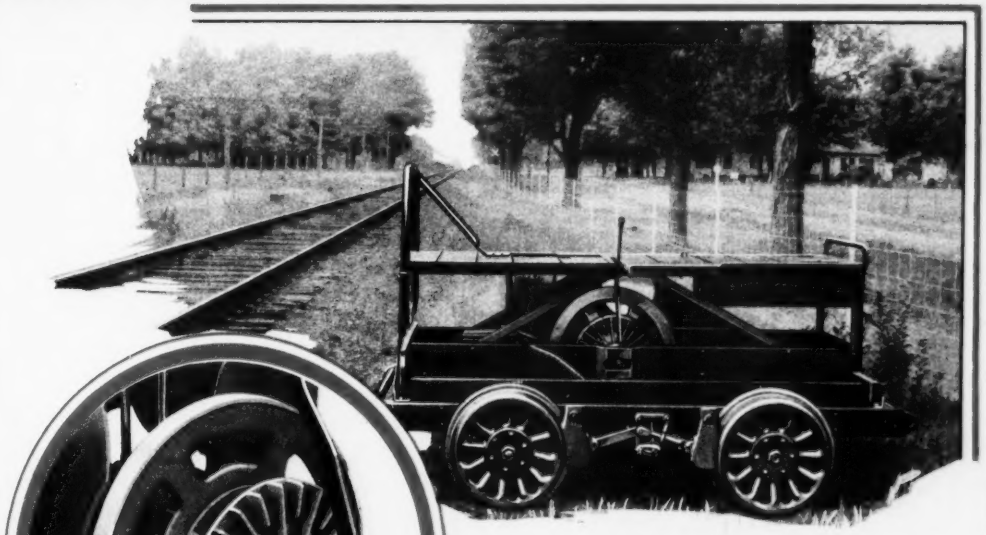
RACOR

SEVEN WORKS
RAMAPO-AJAX-ELLIOT
HILLBURN, NEW YORK
NIAGARA FALLS, N.Y.
CHICAGO, ILLINOIS
EAST ST. LOUIS, ILL.
PUEBLO, COLORADO
SUPERIOR, WISCONSIN
NIAGARA FALLS, CANADA

HEAVY DUTY HEAT TREATED GUARD RAIL CLAMPS
DROP FORGED RAIL BRACES
ADJUSTABLE RAIL BRACES
EUREKA ADJUSTABLE CLIPS
MANGANESE REINFORCED SWITCH POINTS
RAMAPO AUTOMATIC SAFETY SWITCH STANDS
AJAX MANGANESE ONE-PIECE GUARD RAILS
SWITCHES – FROGS
CROSSINGS – SPECIAL
RAILWAY TRACK WORK

Main Office – HILLBURN, NEW YORK
SALES OFFICES AT WORKS, ALSO
30 CHURCH STREET, NEW YORK
McCORMICK BUILDING, CHICAGO

RAMAPO AJAX CORPORATION



This simple, fool-proof clutch, with cooling fins and other finely worked out details, insures positive, smooth action and will not burn out

The Sheffield 44

—proved by its record on the rails

This simple, powerful section car—the Sheffield 44—has undergone every conceivable test and has proved equal to every demand and condition. Back of its tremendous popularity is the performance which this car gives. And back of performance its construction, based on time-tested, perfected section motor car design.

The perfected clutch transmission with positive chain drive is admittedly the biggest advance made in railway motor car construction. The clutch is absolutely fool-proof—practically indestructible. It *can't be burned out.* It is extremely simple and easy to operate. Various speeds are obtained and loads easily started by slipping the clutch. No tugging at tension levers. No delays due to broken belts.

In addition to this advanced type of drive, the Sheffield 44 has many other features that have made it *the* leading car in its class. Improved design in the single-cylinder, two-cycle engine cuts down gasoline consumption to the minimum. The engine is fully accessible. The pressed steel frame, automobile type, combines great strength with lightness. Uncompromised quality construction and perfected features, such as heretofore have been obtainable only in cars costing considerably more, are incorporated in this moderate priced, thoroughly dependable section car.

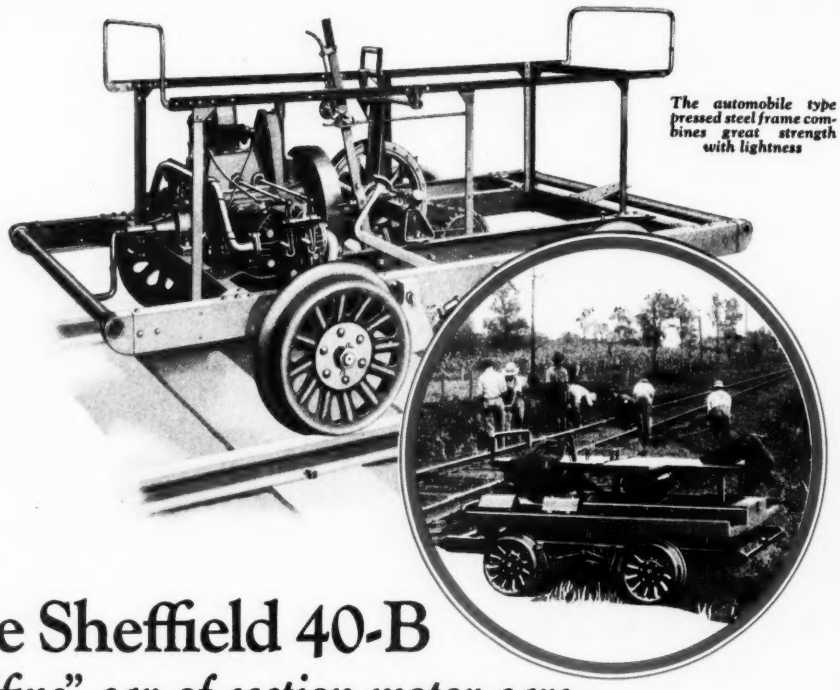
Other Fairbanks-Morse motor cars are described on the next page.

FAIRBANKS-MORSE
was
FIRST *

- * To build a center-load car
- * To use a water-cooled engine
- * To use a gear drive
- * To use a chain drive
- * To use a free-running engine
- * To use a clutch drive
- * To use a two-cycle engine
- * To use a pressed steel frame
- * To use wood center wheels
- * To use pressed steel wheels
- * To use a self-priming engine

FAIRBANKS-MORSE
MOTOR CARS

First on the rails — and still first



The automobile type pressed steel frame combines great strength with lightness

The Sheffield 40-B

the "fine" car of section motor cars

Whenever a thoroughly fine car is wanted for meeting all the different requirements of section and extra gang service, consideration must inevitably narrow down to the Sheffield 40-B, for no finer section motor car is built. The superlative service and outright dependability of the 40-B have never been excelled.

In design this car is patterned after the best in automotive construction, as evidenced by three-point suspension of engine, and automobile type of pressed steel frame. The friction transmission is greatly simplified. Large Timken roller bearings carry the drop-forged, heat-treated, high carbon steel crankshaft, absorbing all thrust as well as radial loads. The engine is of improved two-cylinder four-cycle valve-in-head design, and three-point suspension positively prevents misalignment.

Unquestionably this car represents the highest development in section motor car construction. It is a long-life, low maintenance car—the greatest value per dollar invested that can be offered the section car user.

The Sheffield 41

filling a definite, widely felt need, has been so generally adopted that it is recognized as *the* leading center-load inspection car for roadmasters and linemen—for signal service and engineering work.

The Sheffield 45

recently added to the Fairbanks-Morse line of section motor cars — has two-cylinder four-cycle air-cooled free-running engine and friction transmission. It is of the same high grade construction as the Sheffield 40-B, but is a lighter car and not as highly powered. Carries the largest deck space ever provided—22 square feet of unobstructed tool space.

The Sheffield 32

after 15 years on the rails, has deservedly earned the reputation of having the lowest maintenance cost of any section car ever built. Widely used for transporting crews and tools where grades do not exceed one percent.

FAIRBANKS, MORSE & CO., *Chicago*

Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; oil engines; steam, power and centrifugal pumps; scales; complete coaling stations

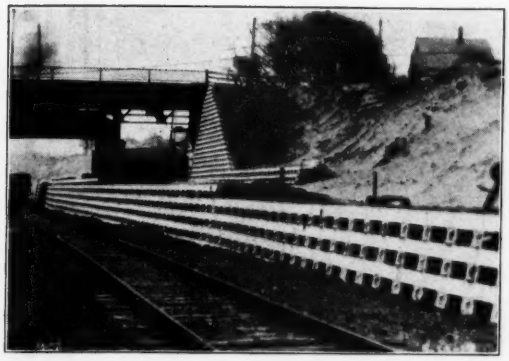
FAIRBANKS-MORSE

MOTOR CARS

First on the rails — and still first

A-924

Cut the Cost of Retaining Walls 50 per cent



R. C. Products were used here by Cleveland Rapid Transit Co.

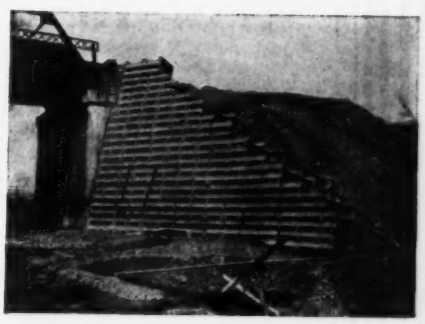
You can do it as other engineers throughout the country are doing it—by specifying

R. C. AUTOMATIC INTERLOCKING FLEXIBLE Concrete "I" Beams

R. C. Units have three distinct advantages:

1. Walls can be erected easily by common labor. The Beams interlock firmly and a small gang can erect the wall in half the time.
2. They require no massive foundation.
3. They can be salvaged 100% and moved from job to job.

It is obvious why leading engineers who profit by advanced practice recommend R. C. Units.



Wing Wall for the Otis Steel Co. at Cleveland

We will gladly give you complete information about R. C. Units, how, where, and by whom used, and, upon receipt of plans we'll quote you on any particular job.

This is information which should be in the possession of every engineer who keeps abreast of modern methods.

THE R. C. PRODUCTS COMPANY, INC.

1048 Engineers Bldg., Cleveland, Ohio

Branch Offices: New York—293 Pearl Street.
Chicago—568 Peoples Gas Bldg.

THE OXWELD RAILROAD SERVICE COMPANY

representing

THE LINDE AIR PRODUCTS CO.
(Linde Oxygen)

THE PREST-O-LITE CO., Inc.
(Prest-O-Lite Acetylene)

UNION CARBIDE SALES CO.
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OXWELD ACETYLENE CO.
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Railway Exchange
Chicago

30 East 42d Street
New York

A Mouthful at Every Bite

WHEN you buy a bucket, there is one thing you want above all else. That's digging ability. For when a bucket can't dig, it can't get a heaping load. But Owens are nationally known as buckets which, like the jungle tiger, get a mouthful—at every bite.

Then there's performance—the day-after-day kind. It takes a sturdy bucket, built to meet actual working requirements, to tear away a mouthful every time the closing line is overhauled. Yet, Owens have been doing that for eighteen years.

These are two of the things you have a right to expect when you buy Owen Buckets. Of course, there are other reasons—seven of them—why you get what you want in an Owen.

Write for the complete story of Owen Buckets and the other seven distinctive points of superior construction.

The OWEN BUCKET Co.

105 Rockefeller Building Cleveland, Ohio

Baltimore Chicago Dallas Los Angeles Minneapolis Philadelphia
Pittsburgh New York Miami Portland St. Louis San Francisco

INSURE A BIGGER DAY'S WORK

C O. B. Co.

A Million Ties of Proof

Awaiting the Word from You

AT ***International*** Plants Quality and Service have distinctive meanings and here are a million ties of proof. We only wish you could see them yourself.

Every tie represents the highest quality—sound timber—full size and accurately graded. ***These ties are ready for you now!***

In addition you get a service that results from combining the sincere desire to produce quality standard specification ties with adequate plant and service facilities.

The ***International*** Dating Nail on ties means Quality in them. The fact that you have never tried ***International*** Tie Service before merely argues that you should begin now.

Ship today service—quality ties in any quantity

2IC6

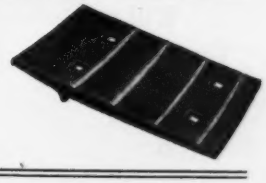
The International Permanent Pledge Mark of Quality

International Creosoting & Construction Co.
General Office: Galveston, Texas
Plants: Texarkana, Texas Beaumont, Texas
Galveston, Texas

International
Standard Specification Ties

LUNDIE TIE PLATE

Prevents cutting of a single fibre of the tie



TIE protection against mechanical wear depends entirely upon the type of tie plate used.

Money spent on costly treated ties is lost when the cutting ribs of ordinary tie plates eventually break down the wood fibers allowing moisture to go below the safety line of penetration. Premature decay then prevents the treated tie from delivering its full return on the investment.

By scientific design the Lundie Tie Plate develops beneath the plate a hardened wear-resisting surface that assures absolute tie protection under the heavest traffic conditions.

It is this tie conservation and fewer replacements that bring to railroads substantial savings in maintenance cost. This sound basis of ultimate economy each year is influencing more roads in their choice of the Lundie Tie Plate.

The Lundie Engineering Corporation
285 Madison Avenue, New York
166 West Jackson Boulevard, Chicago

Tie Plates That Protect

Note remarkable surface protection on illustrated tie after 8½ years under the heaviest traffic conditions.

HACKMANN COMBINATION TRACK LINER

SAVES 60% OF YOUR LABOR AND TOOL COST

HACKMANN Track Liners Will Line Track, Frogs, Switches, Space Ties, Raise Low Joints, Without Disturbing the Road Bed. No Digging Necessary

60% Labor Cost Saved

3 Men With Hackmann Track Liners Do the Work That Required 9 to 12 Under the Old Method Hackmann Track Liners Will Pay For Themselves By the Saving in Labor Cost

NO. 1 LINING BAR

HACKMANN COMBINATION LINING BARS

(VERONA MADE—HEAT TREATED)

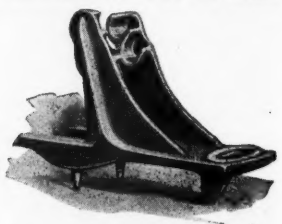
The No. 1 lining bar with chisel end and the No. 2 combination tamping and lining bar are drop forged from special steel specially tempered with 1-inch drop forged lugs as an integral part of the bars, for use with Hackmann bases.
Tests on different roads have proven conclusively that the new Hackmann Combination Track Liner gives more than double the efficiency of any liner now on the market.

DEMONSTRATIONS

We Will Gladly Demonstrate the Efficiency of This Equipment Upon Request

NO. 2 TAMPING AND LINING BAR

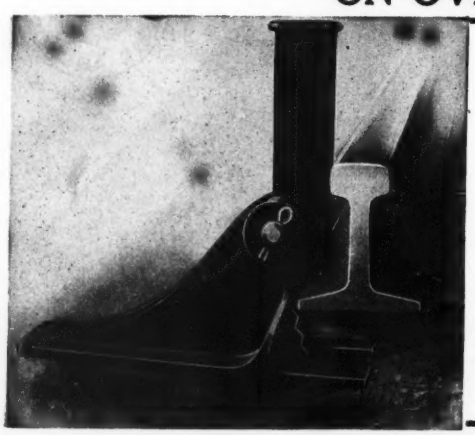
NOTE THE TWO STEP FEATURE AT TOP OF BASE



You can make at least two pulls without resetting the liner. Just move the bar to the top notch.

Weight 20 lbs.

MORE THAN 13,000 OF OUR LINERS NOW IN USE ON OVER 100 RAILROADS



The IDOL TRACK LINER

The Idol Track Liner will line track frogs, switches, space ties, raise low joints without disturbing the road bed as no digging is necessary. They will pay for themselves every day by work you will be able to do with a few men. They will save you 50% in labor costs.

The Idol Track Liner can be operated with any ordinary lining bar.

THE HACKMANN RAILWAY SUPPLY CO.

RAILWAY SAVING DEVICES
723 So. Wells St., CHICAGO, ILLINOIS

VERONA TOOL WORKS
New York, N. Y. Boston Mass.
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FREDERICK HACKMANN,
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THE HOLDEN CO. Ltd., Canada
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Ring OUT the OLD!

Patents Pending

Ring IN the NEW!

DO AWAY WITH THIS DAILY DOZEN

THE OLD—Open Frame Pumps with a dozen grease cups requiring attention several times daily.

THE NEW—Gardner Enclosed Self Lubricating Pumps with *one* place to oil, ***ONCE A MONTH.***

With motor drive, this pump is especially suited for remote control in Railway water service. Controlled at any distance, with a switch, it requires personal attention only once each month. Send for Bulletin EP-1.

THE GARDNER GOVERNOR COMPANY
Quincy, Illinois

CHICAGO 549 Washington Blvd. | NEW YORK 534 Singer Bldg. | PHILADELPHIA 604 Arch St. | HOUSTON 1242 Heights Blvd.

SAN FRANCISCO 401 Rialto Bldg. | LOS ANGELES 2122 E. Seventh St. | LONDON 25, Bishopsgate, E. C. 2.

GARDNER GOVERNORS PUMPS COMPRESSORS

GARDNER

HART SELECTIVE CAR WITH "MAXENDS"

FOR BALLAST AND COAL

"MAXENDS" PROVIDE FACILITIES FOR PEDDLING BALLAST WHERE NEEDED, AS FLOW CAN BE CUT OFF AS DESIRED

DISTRIBUTING BALLAST TO CENTER AND TO ONE SIDE

Each side is operated independently in full view of the operator. Amount of distribution under control, as desired for shoulder reinforcement.

100% Side and Center Dump

Operating mechanism is absolutely self-locking. Load is carried on automatic safety locks—No dependence on chains.

Illustration shows actual work being done by this car, depositing material simultaneously to center and outside of elevated rail on curve for reinforcement.

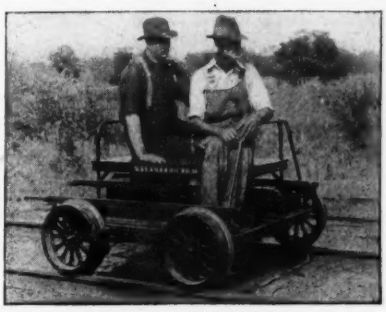
Illustration shows same piece of track after car has passed. Note even distribution of material, no hand work having been done.

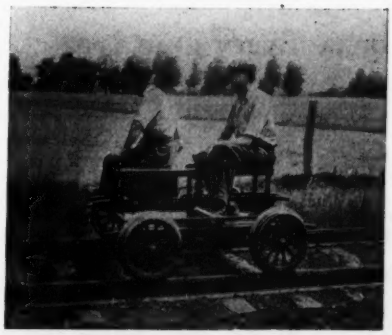
RODGER BALLAST CAR COMPANY

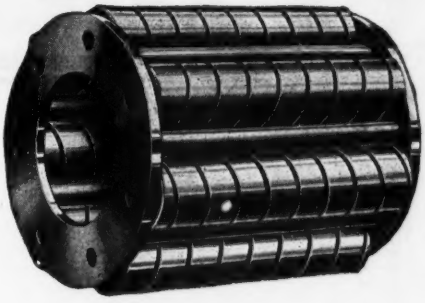
523 Railway Exchange, 80 E. Jackson Blvd., Chicago

30 plus 50 plus 80% — savings

Maintenance Cars Roll Up Positive Savings with Hyatt Roller Bearings in the Journals







YEARS of service on railways from Coast to Coast, Alaska to Cape Horn prove conclusively that cars equipped with these positively lubricated, easy rolling, dependable bearings—

SAVE

30% on gasoline consumption
50% on friction resistence
80% on lubrication costs

Because Hyatt equipped cars operate months at a time without attention of any kind, constant tinkering is eliminated—thus releasing the full section crew for roadbed work.

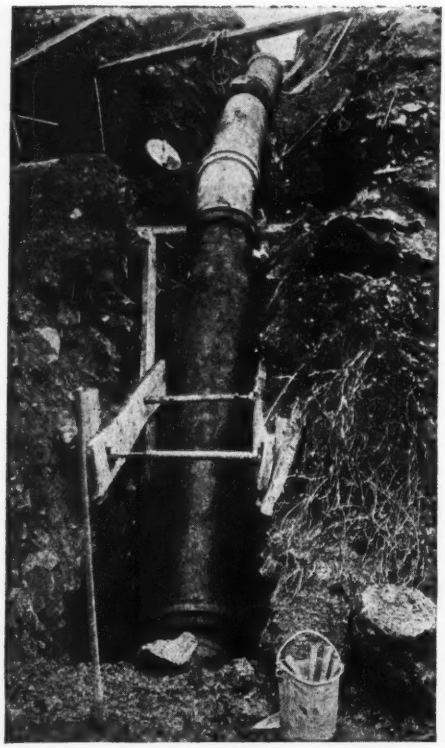
Leading builders of maintenance cars in this country and Canada build Hyatt Roller Bearings into new cars and furnish replacement boxes to fit present equipment.

Hyatt Roller Bearing cars pay dividends—investigate them.

HYATT ROLLER BEARING COMPANY

NEWARK DETROIT CHICAGO SAN FRANCISCO
WORCESTER PHILADELPHIA CHARLOTTE
PITTSBURGH CLEVELAND

HYATT
ROLLER BEARINGS



In Difficult Situations

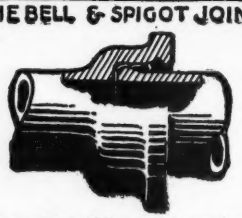
Cast Iron Pipe eliminates delay and extra expense where unforeseen obstacles are encountered. It is not necessary to hold up the job while special pipe and fittings are being made. Cast Iron Pipe, because of its adaptable Bell and Spigot joint, its short lengths, and its standard special castings easily obtainable, makes construction like the above a simple matter.

Cast Iron Pipe is readily cut when necessary. Every joint is a field joint, and each is as good as the next one.

THE CAST IRON PIPE PUBLICITY BUREAU, Peoples Gas Building, Chicago

CAST IRON PIPE

THE BELL & SPIGOT JOINT



THE ACCEPTED STANDARD FOR UNDERGROUND CONSTRUCTION

Our new booklet, "Planning a Waterworks System," which covers the problem of water for the small town, will be sent on request

Send for booklet, "Cast Iron Pipe for Industrial Service," showing interesting installations to meet special problems

The Biggest

RAIL-TIE-ROADBED-JOINT

Saver

Ever Put on a Rail

HEAD-FREE
Continuous
JOINT

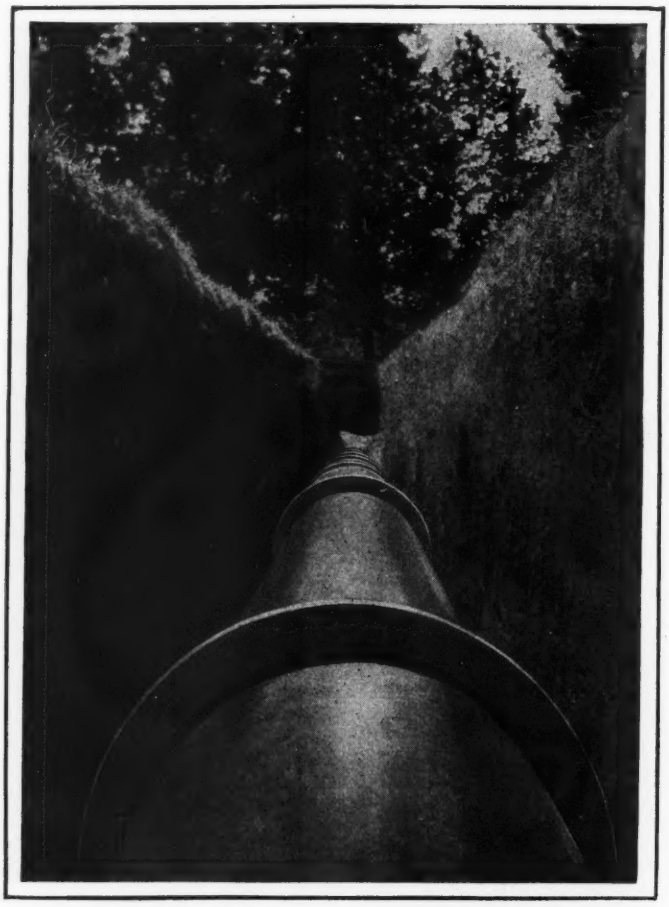
A
Proven
PRODUCT

A thorough investigation can save your railroad

A Lot of Money

The Rail Joint Company

61 Broadway New York City



Cast Iron Pipe in the deep trench of a filter plant approach.

Empty or full, cast iron pipe stands the strain of even the deepest fill

ONE of the many reasons why cast iron pipe is the accepted standard is this factor of strength—no danger of collapse.

Send for a copy of the United States Cast Iron Pipe hand book. It is full of the most valuable data.

United States Cast Iron Pipe and Foundry Company

General Offices:
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SALES OFFICES

Philadelphia: 1421 Chestnut St.
Chicago: 122 So. Michigan Blvd.
Birmingham: 1st Ave. & 20th St.
New York: 71 Broadway
Buffalo: 957 East Ferry Street
San Francisco: 3rd & Market Sts.
Pittsburgh: 6th & Smithfield Sts.
Dallas: 1313-1315 Main St.
Kansas City: 13th & Locust Sts.
Cleveland: 1150 East 26th Street
Minneapolis: 6th St. & Hennepin Ave.

The Poage Universal Spout will be on display at The National Railway Appliance Exhibition, at the Coliseum, Chicago, March 8th to 11th, 1926. Space 130, 131, 132 and 133.

PATENT APPLIED FOR

POAGE *UNIVERSAL*

A Telescopic Spout That Meets New Water Delivery Conditions

Among the many new conditions constantly confronting railroads is that of adapting water columns now in use to the constant changing of equipment.

Tenders are now in use with the manhole 12 feet over rail. In addition to this, many have guard rails and other obstructions that increase the height to 16 feet.

The great problem is to obtain a spout that will accommodate these tenders and at the same time deliver water to a tender with a manhole but 8 feet over rail.

The POAGE *Universal* Telescopic Spout will do this without the least waste of water.

The extraordinary range of the POAGE UNIVERSAL Spout does not exist in the Fenner or any other telescopic spout.

It will deliver water to the highest tender and also the lowest.

It can be applied to any POAGE Water Column now in use.

Send us your requirements and we will tell you how the POAGE UNIVERSAL Spout will meet them.

THE AMERICAN VALVE & METER CO., Cincinnati, O.

Branch Offices:

Chicago, Ill., McCormick Bldg.
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Sole Canadian Representatives:

The General Supply Company of Canada, Ltd.

Ottawa Toronto Montreal Moncton

SPEED

ECONOMY

SAFETY

20 Cars Dumped in 5 Minutes

THIS performance exemplifies the speed, economy and safety which predominate wherever Extension Side Dump Cars are used.

The air supply system provides for the dumping of the twenty cars by the operation of one valve handle—that means

SPEED

The down turned door serves as an extension to the car floor and chutes the load clear of the trestle—that means speed plus

ECONOMY

The rolling motion of the car body to full tilted position eliminates excessive shocks. In full dumped position, the side of the car is completely out of the way. That means

SAFETY

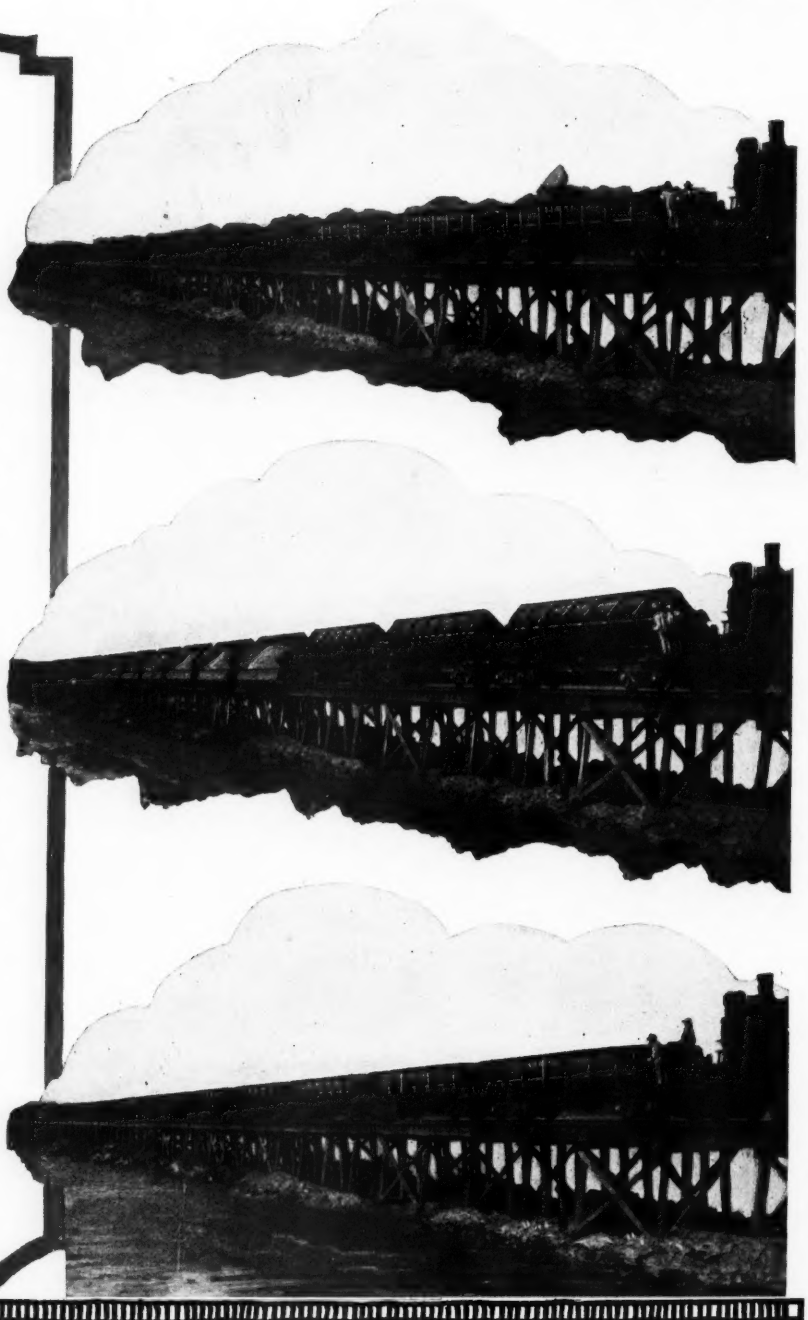
To save most and serve best, dump car equipment should possess all these advantages.

CLARK CAR COMPANY
PITTSBURGH, PA.

New York
52 Vanderbilt Ave.

Chicago
122 S. Michigan Ave.

San Francisco
Rialto Building



Extension Side Dump Cars
··Air Operated··

Railway Engineering and Maintenance

Volume 22 January, 1926 Number 1

THE MATERIALS A RAILWAY USES

WE ARE so accustomed to deal in large figures in these days that they have lost much of their impressiveness for us. For this reason we are apt to lose sight of the magnitude of the requirements of the railways for materials for the upkeep of their properties. Because of this fact the following statistics are presented covering the materials actually used during 1925 in the maintenance of the 8,136 miles of tracks in the 3,111 miles of New York Central lines east of Buffalo. Prominent among these materials were 1,320,000 creosoted ties or sufficient for a continuous line of track from the Grand Central terminal in New York City to a point 25 miles from Buffalo. A total of 55,000 tons of rails was also laid, sufficient for 344 miles of tracks. To support these ties and rails, 440,000 cu. yd. of crushed stone were used. Approximately 20,350 switches are included in these lines, which are renewed at the rate of 1,500 per year. To install and maintain these materials a force of 3,000 men was employd during the summer season in addition to the regular section forces.

BRIDGE SURVEY PLATS

ONE SOURCE of intimate contact between the division maintenance forces and the system engineering officers is brought about through the preparation of information from which decisions are made for the layout of new bridges and which also serves as the basis for the development of the detailed plans. However, a wide variation prevails with respect to the extent of this information. On those roads on which the actual layout of bridges and culverts is left to the division organization the data supplied to the system officers is usually rather meager, while on those roads on which complete working plans are prepared in the system bridge office, it is necessary that the data supplied by the field forces be sufficiently complete to enable the designers to visualize the site with sufficient accuracy to permit the plans to show the exact location of piers, the splay of wing walls, etc.

This information usually takes the form of contour maps and profiles, often on two different scales, to afford a clear idea of the general surroundings as well as the exact nature of the bridge site itself. Under this second plan the field forces are given specific instructions as to the information they are to furnish and their responsibility ends when this information has been submitted. Under the other arrangement they supply only information of a general nature to form the basis for a decision as to the type of bridge and later make whatever additional investigation is necessary for the purpose of fitting the approved bridge plan to the site. This plan has the objection that the information supplied may be so meager as to handicap the bridge engineer and his assistants in the preparation of preliminary studies for different types of structures. Furthermore, the complete bridge location plat comprises a permanent record of the site and the general surroundings of the bridge which should prove of as much value to the division maintenance organization as to the bridge engineer or chief engineer for future reference, and once the basic surveys have been made it requires but little additional work to indicate any future changes in the structure or in the location of the stream channel, etc.

A PROSPEROUS NEW YEAR

THE YEAR that has just closed was a successful one from the standpoint of the railways as a whole and particularly from the standpoint of the engineering and maintenance of way department. It was a year of good traffic and earnings. It was free from serious floods, labor troubles and other disturbances that interrupt the orderly conduct of operations. Money was available for necessary expenditures, with the result that tracks and structures are now in better condition than at any time since 1914.

The outlook for 1926 is for a continuance of this situation. All indications point to increased industrial activity and a correspondingly heavy traffic for the roads during at least the first half of the year. As a result, the managements are planning liberal expenditures for the enlargement of their facilities and particularly for other improvements in directions that will reduce costs of operation. Indicative of this trend is the amount of construction work carried over into the new year and projected for 1926, as outlined elsewhere in this issue, as well as the large orders for rails and track fastenings for current maintenance. The railways have won the confidence of the public to a degree that they have not enjoyed for years. The policy of the managements in proceeding with the improvement of their properties at a time when a surplus capacity exists is an indication that they expect to continue to merit this favor by giving good service. With all, 1925 was a good year for the railways. The outlook for 1926 is equally encouraging.

THE LAST TRACK TIE AND THE FIRST BRIDGE TIE

PROBABLY the best answer which is given in the What's the Answer department of this issue concerning the shimming of track on the ends of bridges to compensate for heaving on the approaches is that the track on the approaches should be maintained in such condition that no heaving will occur. Success in

carrying out this suggestion to the extent that no shimming will be necessary will do much to improve conditions at the ends of bridges.

It will not, however, afford a complete answer to the problem of maintaining a satisfactory transition of the track from the yielding roadbed to the rigid bridge construction, which imposes upon the track foreman the difficult task of tamping the last track tie to such a degree of perfection that it will afford as nearly as possible the same amount of support under the rail as that afforded by the first tie on the bridge. Neither will it give a satisfactory answer to the problem which arises when a general ballast raise is under consideration with the necessary runoff to the fixed grade of the track across the structure.

These and other problems arising in conjunction with the transfer of a stretch of track from the roadbed to the deck of a bridge have unquestionably exerted more influence in the general tendency towards the use of ballasted deck bridges than any other consideration for while the introduction of the ballasted deck introduces new problems of bridge maintenance, it surely has eliminated some serious problems of track maintenance.

SPENDING TO SAVE

IN AT LEAST one important respect the railways may profit from the example of the leading public utility companies—namely, that it is not sufficient merely that a plant or a unit of equipment be able to render a certain service, but it must also render that service economically. The public utility field is replete with instances where one unit of equipment has been replaced by another of improved design long before it has worn out because the newer unit showed a saving in operation sufficient to warrant buying it and discarding the other.

The engineering and maintenance of way department uses a relatively large amount of work equipment such as ditchers, steam shovels, locomotive and other types of cranes, pile drivers, motor cars, etc. It is adding other equipment in the form of rail laying and ballast cleaning machines, etc. It also employes a wide variety of power equipment in water and coaling stations, and similar service.

It is the common practice to retain this equipment in service until it wears out or becomes inadequate to meet the demands made on it. Little attention is ordinarily given to obsolescence or the economy of replacement with more modern equipment solely because of the reduced cost of operation with the newer units. In their failure to appreciate this principle the railways trail far behind many of the utilities with the result that they are paying the penalty in high operating costs.

Development in practically all lines of power-operated machinery has been rapid in recent years. In many instances costs of operation have been reduced to such an extent that equipment only a few years old can be retired and newer units substituted with a saving. Yet all too frequently the railways look primarily at the first cost of this equipment, losing sight of the savings in operation that are possible. As a result units are continued in use year after year without the drain in operating charges being noticed.

With the increase in railway earnings and the resulting improvement in railway credit, the time has come when less emphasis should be placed on capital expenditures and more on operating costs. Rather than discouraging expenditures for new equipment, this attitude will encourage them whenever the appliances can be shown to earn a reasonable return over and above the interest on the added investment. The engineering and maintenance of way department is cluttered with equipment that it cannot afford to operate and which should be replaced, and the officers in charge can well afford to study it carefully to determine how much of their equipment they can save money on by retiring. They can also further the same end by studying the methods employed in their various operations to ascertain wherein they can be "modernized" by adaptation to new equipment. By thus "spending to save" they can bring the efficiency of their operations to a higher level and the cost of their work to a lower figure.

AN EXAMPLE OF THOROUGHNESS

WHILE THE description of the results that have been secured from cross ties on the Buffalo, Rochester & Pittsburgh affords a striking example of the economy of timber treatment, it is even more outstanding as an evidence of a growing appreciation by railway officers of the magnitude of a railway's investment in ties and of their responsibility in the scientific handling of ties from the time they are cut from the trees until they are removed from the track at the expiration of their service life to the end that this investment will yield its maximum return. The economy of the treatment of cross ties is no longer questioned in well informed circles today but it is not as commonly recognized that treatment is not enough and that the benefits of treatment may be largely, if not entirely, lost if the ties are not otherwise protected at the same time. The thoroughness with which ties are protected against unnecessary injury throughout their service on the B. R. & P. is unusual because of its consistency. For this reason it affords an opportunity for profitable comparison with the methods in effect on other roads.

Outstanding among the evidences of the thoroughness of its methods, following the adoption of the full cell treatment, is the insistence that all ties removed from tracks that are in condition for shipment be returned to the treating plant for examination. While this measure may appear unwarranted to many and would probably be impractical on a large railway system, it does afford a knowledge of the condition of the ties as they come out of the track and of the reasons for their removal that is not otherwise possible. There is, therefore, no conjecture regarding the character or the results of treatment, for the facts are available and there is no necessity for guesses or estimates. Neither is there any opportunity for the records to be weakened by inaccurate or superficial reports to the effect that "ties were removed because of decay," when, as has frequently occurred, the decay is the result of mechanical abuse and is a secondary rather than the primary cause of failure.

Another outstanding measure is the protection afforded the tie against mechanical abuse. Not only are all ties in the track protected with plates, but it is insisted that the ties be handled with tongs, dragging them into place with picks or shovels being forbidden. While the incorporation of regulations to this effect in books of rules is not unusual, their enforcement is disappointingly rare, with the result that the beneficial effects of treatment are seriously reduced on many roads by unnecessary abuse in their subsequent handling. More unusual is the insistence that ties shall not be injured while being thrown from the cars in unloading. While many maintenance officers may consider this an unnecessary refinement, it is another

evidence of the determination of the B. R. & P. to secure the maximum return from the investment already made in timber and in its treatment.

The measures in effect on this road stand out as examples of a consistent policy with reference to the handling of ties, developed with the idea of securing the maximum service from the largest expenditure which a railway makes for any one material with the single exception of fuel. As such it affords much of interest and value to other railways. It is not surprising that present indications point to an anticipated life of 25 years from the ties on this property; a goal which if attained or even approached will amply repay the management for the measures taken.

IS A STRONGER TRACK COMING?

IS THE TIME approaching when a stronger and more rigid track construction will be required? Traffic is increasing in weight and in density and the service demanded of the track is constantly growing more severe. As a result, the cost of maintenance has mounted steadily until it now ranges from $1,500 to $4,000 per mile of main track today, the larger part of which is expended directly on the track itself. To meet the demands of service, various units of the track structure are being strengthened. The weight of the rail has increased relatively rapidly in late years. Larger and heavier tie plates and stronger joints have been designed and more ballast has been added. Yet the foundation has remained but yielding earth. There has been a feeling of late years that a more stable foundation construction was desirable and in several instances this has taken the form of a concrete base. To date, however, the limited experiments that have been made have been at the points where particularly adverse conditions prevail as in the Union Station at Chicago and in the vicinity of Poughkeepsie, N. Y., on the New York Central.

At the annual dinner of the American Railway Engineering Association last March, Frank H. Alfred, president and formerly chief engineer of the Pere Marquette, emphasized the necessity for a more permanent form of track construction. His subsequent studies have led to the development of a design of heavy concrete slab construction presented on another page, with an estimate of the economies that should result therefrom. The thoroughness with which this suggestion has been worked out challenges attention. While the practicability and the economy of this form of construction are yet to be demonstrated, its possibilities are many. If successful, its first effect will be to reduce maintenance of way costs and if these costs are reduced sufficiently to more than offset the interest on the increased investment, the expenditure will be warranted from this standpoint alone. Entirely aside from the reduction in maintenance cost, however, is the possibility that construction of this character may reduce the maximum stress to which rails are subjected, an important consideration in the present study of rail failures. It is also possible that this construction may go far in removing the limitations on axle loadings that prevail at present.

Mr. Alfred has presented the suggestion for a stronger track construction in tangible form. The possibilities of this subject are so great that it is to be hoped that it may receive the careful consideration of railway executive and maintenance officers. It is also to be hoped that the suggestion may receive a practical trial at some point where the conditions are sufficiently severe to test its merits and to determine its economy.

Letters to the Editor

DON'T BE IN TOO BIG A HURRY

Logan, Ohio.

To the Editor:

The November issue of *Railway Engineering and Maintenance* contained a letter by D. D. Gay, a section foreman on the Chicago, Rock Island & Pacific, which I read with considerable interest. In this letter he described his method of organizing his track gang when riding on a motor car so that the car may be taken off the track quickly whenever it is necessary to do so. I like this plan of organization. Every gang should be organized for this operation or anything else it is to do before a start is made. However, I do not think a gang should often be compelled to hurry when taking a motor car off the track for some one is likely to get hurt. Motor cars should be protected with a red flag in close places such as sharp curves or cuts so that there will be no need for hurrying when the car must be taken off. D. T. McKee,
Section Foreman, Hocking Valley.

CARE IN UNLOADING TIES

Tama, Iowa.

To the Editor:

I have long watched an old foreman distribute his ties and believe there is much in his methods that other foremen can follow to advantage. He always received his ties during the winter and arranged for them to be unloaded from a train in piles of 40 or 50 at the ends of cuts or on level areas on the right-of-way. Thus he never has to drag any ties up an embankment or out of a ditch. From these points he distributes his ties more accurately by the use of a push car, placing them in small piles adjacent to the point of their insertion. In doing this he also sorts them so that the larger ones are available for use at the points of severest service.

This foreman has 28 switches on his section and when ordering ties for them he starts at one end of the yard with a small note book and a tape line and records the length of every tie that is to be renewed in each turnout. In this way he has a record of the exact number of ties needed for every turnout and never finds that they are too long or too short. This foreman also makes it a point to learn from the roadmaster how many ties he will be allowed. Old Timer.

"The Permanent Way," a London, Midland & Scottish Poster

Building A More Permanent Track

A Reinforced Concrete Slab Is Suggested to Support the Rails. Marked Savings Anticipated

By FRANK H. ALFRED AND PAUL CHIPMAN

President and General Manager, and Office Engineer, Respectively, Pere Marquette

THE type of track now in use by the railroads was evolved very early in their history and has been retained ever since without essential change. To keep pace with the increase in the weight of equipment and the volume of traffic, heavier rails with stronger fastenings of improved pattern have been used, the depth of the ballast has been increased, and the ties have been placed closer together; but the general arrangement is still the same. On account of its adaptability to the varying conditions incident to the growth of the railway system, such as an unseasoned roadbed and frequent changes in line and grade, no other type of track could have served the purpose as well, on the score of either efficiency or economy.

But on most of the railroads in this country a different set of conditions is now encountered. Traffic routes have become fixed. Few changes of line or grade which involve any considerable mileage are contemplated. Embankments have become seasoned and, for the most part, show no further settlement. Wheel loads are approaching the maximum which is permissible, unless steel rails can be made both harder and tougher than at present. The increasing cost of ties is only partially offset by the longer life obtained by treatment. Suitable ballast is increasingly more expensive and track labor is becoming scarcer and, measured in performance. more costly.

A More Permanent Track Is Desirable

Altered conditions in highway traffic were promptly met by the development of a new type of pavement. Likewise the street railways rapidly developed types of track structures which are well adapted to their peculiar conditions. The time has now arrived when careful consideration should be given by the railroads to the development of a type of track which is more suitable to present conditions on heavy traffic lines. Some pioneer work has bene done along this line, both as to suggested design and actual construction, experimental or otherwise. Of the former, J. W. Schaub's contributions on the subject as long ago as 1907 are notable. (See Railway Age of May 31, 1907, page 835, and Railroad Age Gazette of November 27, 1908, page 1431.) In 1919 A. C. Irwin described a number of such types of track in a paper before the American Concrete Institute. The principal cases of actual construction carried out up to the time of its publication are described in Volume 21 of the Proceedings of the American Railway Engineering Association for 1920.

Such an installation, even on an experimental scale, is necessarily expensive; and before such expense is incurred it is desirable not only to profit by past experience, but also to consider such suggestions as may be offered by all who are interested. This article is written in the hope that the design of track herewith submitted and the estimate of the savings which would result from its use will stimulate interest in this matter and will bring forth constructive criticism which will not only result in the improvement of the design, but will also throw more light on the economic value of a track of this type. Comments on the part of those who have had experience in regard to track of the permanent type on either railroads or street railways will be especially welcome.

By permanent track is meant a track structure in which wear and deterioration are confined as far as possible to the rail. The requirements for such a track structure are most exacting—so much so that in certain situations they cannot all be met with the design here submitted, although it is not unlikely that a type of structure can be developed which would meet even these severe requirements. Such conditions include fills that are not fully settled, fills over sink holes or over ground filled with water which may be removed subsequently by drainage, soils of such texture that freedom from heaving by frost cannot be secured by thorough drainage, and places where changes in connections with side tracks are frequent. However, on old lines these situations comprise only a small fraction of the total, and their existence need not interfere with the use of permanent track on the remainder, if such use is advantageous.

Such a structure must be wide enough and strong enough to distribute the load over such an area that the bearing power of the sub-grade will not be exceeded. Allowance must be made for impact, for lack of uniformity in the support given by the sub-grade, and for the present tendency toward heavier loading. Temperature stresses must be taken into consideration; and protection of the concrete under the rail from disintegration due to repeated shock from the passing loads seems desirable, although trial may prove this feature not to be essential.

The method of attaching the rail should permit of its easy placing and removal. Methods and type of construction must be such that the rail, when laid in its prepared place, will have perfect surface and alinement. However, the design should be such as to permit minor adjustment of elevation by shimming, as occasional slight settlement may be looked for even in seasoned fills, and changes in traffic conditions may make a change in the super-elevation of curves desirable. Ease of insulation is another feature that must not be overlooked. As there will be occasional situations where it will be desirable to retain the present type of track, any design should permit an easy and practicable connection of the two types of construction.

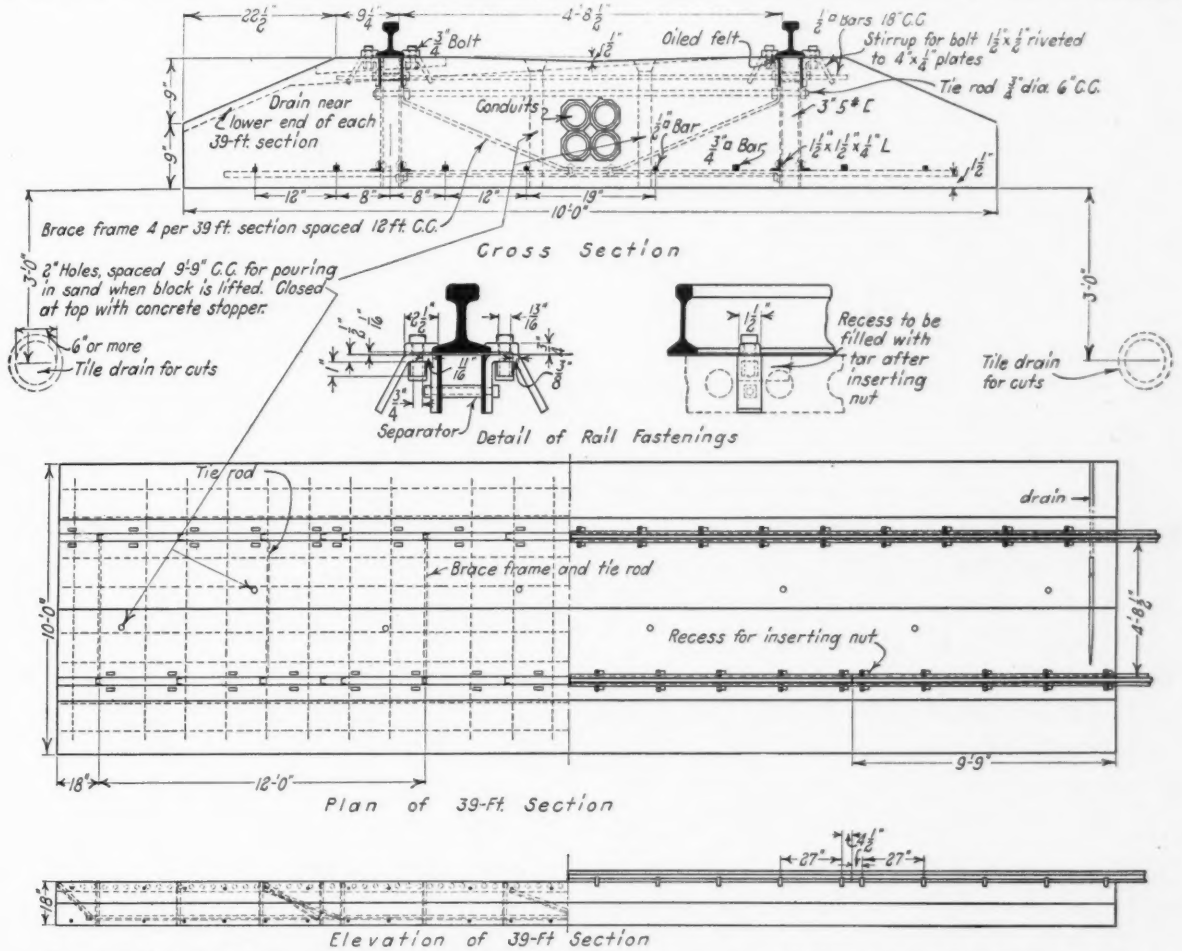
These features have all been considered in the design submitted herewith. The supporting slab of concrete is 10 ft. wide and 18 in. thick. Assuming the use of 39-ft. rails, the concrete would be cast in sections of that length. The rail rests on the edges of two plates which are embedded in the concrete, and are perforated in order to provide better bond and more bearing on the concrete. These serve a fourfold purpose: (1) To distribute the load and impact over

a greater area of concrete; (2) to protect the concrete from shock and possible disintegration due to direct contact with the rail; (3) to afford a means of attaching the rail; and (4) to insure a setting for the rail which is absolutely true as to line and surface. In addition, they form a guide for striking off the concrete surface in finishing.

A Truss Reinforcement is Employed

The plates which form the rail seat also form the upper chord of a light truss, the lower chord of which serves as a part of the longitudinal reinforcement. by 1½ in. by ¼ in. angles which constitute the lower members of the trusses. The ratio of longitudinal reinforcing metal is about 0.37 per cent. Assuming a Cooper E-70 loading concentrated under the axle, with 50 per cent allowance for impact and uniform bearing on the sub-grade, the tensile stress in the steel would be about 9,000 lb. per sq. in. and the compressive stress in concrete would be about 200 lb. per sq. in.

Transverse reinforcement consists of ¾ in. square bars spaced 18 in. center to center near the base of the slab, and ½ in. square bars spaced 18 in. center to



Proposed Design of Concrete Track Slab in Which the Rails Rest on the Top Edges of the Reinforcing Frames

The vertical members of this truss serve to anchor the rail seat to the concrete, and are extended below the lower chord, so that they may rest upon stakes driven accurately to the elevation of the sub-grade. This truss would be shop-made, and the bracing and riveting need only be of sufficient strength to prevent distortion while handling. When set in place, these trusses are connected by adjustable tie rods spaced 6 ft. apart, and also by the brace frames shown on the drawing. Four of these brace frames are used for each 39 ft. section. One of the tie rods forms the upper member of the brace frame. This arrangement gives a rigid framework which can be set accurately in place and will remain undisturbed while the concrete is being placed. It will also serve to transmit the loads into the mass of concrete.

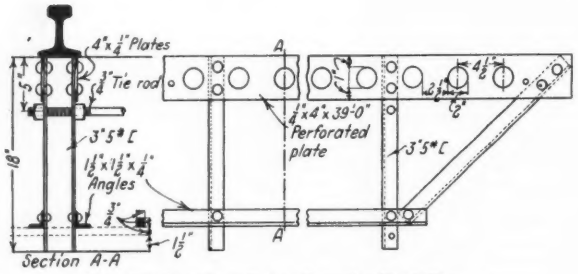
Longitudinal reinforcement consists of four ¾ in. bars and four ½ in. bars in addition to the two 1½ in. center near the top of the slab. Where brace frames and tie rods occur, other transverse reinforcement is omitted. Assuming the 70,000 lb. on a pair of drivers to be uniformly distributed over a longitudinal distance of five feet, and again assuming an impact allowance of 50 per cent and that the upward pressure of the sub-grade is uniformly distributed, we obtain a unit tensile stress of 14,000 lb. for the steel and a unit compressive stress of about 300 lb. for the concrete.

These unit stresses are ample to take care of any increase in future loads, impact and unequal subgrade conditions. On account of the greater length of the section as compared with its width and the consequent opportunity for more variability in the condition of the subgrade it is thought desirable to use a much lower unit stress for the longitudinal reinforcement than for the transverse. With modern methods of proportioning and making concrete the maximum

of economy may be obtained through designing the concrete to meet the actual condition of stress disclosed through experience in the use of this type of roadbed. It might seem that some economy in design could be attained by not using so thick a slab and using a higher percentage of reinforcement. On account of the impact however, it is believed that the additional mass obtained by using a greater thickness is well worth its additional cost.

In order to facilitate construction the concrete slab should be poured continuously, and not in alternate sections. A metal separator would be placed at the end of the section being poured. After the adjoining section had also been poured this separator would be removed. It is not planned to leave any well-defined joints between the sections, on the assumption that compression due to high temperature would easily be taken care of by the concrete, the thickness of which would prevent any tendency to buckle; and that tensile stresses would cause a cleavage at the end of each section, inasmuch as none of the longitudinal metal is continuous. When these joints develop, they should be filled with tar, as is now done with concrete highways. In construction, the removal of the separator would be delayed until at least a portion of the block ahead of it was poured, thus giving the block behind it a start toward setting and insuring a cleavage practically along the plane of the separator.

The rail is held by rail-clips, which are attached by



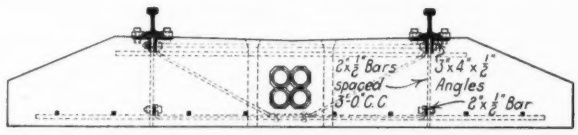
Typical Details of the Longitudinal Frame

bolts to stirrups bolted to the perforated plates and embedded in the concrete. The bolt is placed with the head up and screwed into a nut which is inserted beneath the stirrup through a recess provided for that purpose. This recess is only slightly wider than the nut, thus preventing it from turning. This arrangement tends to lessen the danger of injury to the bolts in case of derailment, and permits their replacement if injury should occur, or the substitution of a longer bolt in case slight shimming is desirable. Nutlocks can be used under the bolt head if desired. No angle bars or fish plates are necessary, as the rail seat and rail attachments serve their purpose.

Secondary Considerations

With such a design, the rail no longer functions as a beam. A wearing surface and a base for bearing and attachment are all that need be provided, so that a much lighter rail may be used than at present. A suggested design for a 60-lb. rail is therefore shown, which it is believed would be fully as effective as a 130-lb. rail under present conditions.

Rail anchors would not be needed. It is possible that creeping of rail could be avoided by keeping the bolts near the center of the rail tighter than those at the end. If this did not prove satisfactory, the rail could be anchored by one or two bolts near its middle point, thus insuring the expansion and contraction of each rail as a separate unit. If it should prove desirable, which does not appear probable, to give a slight cushioning effect and lessen the impact on the concrete, it is believed that a thin layer of oiled felt beneath the rail would be effective. This felt should be treated with some bituminous mixture in order to preserve it. This mixture should not contain too



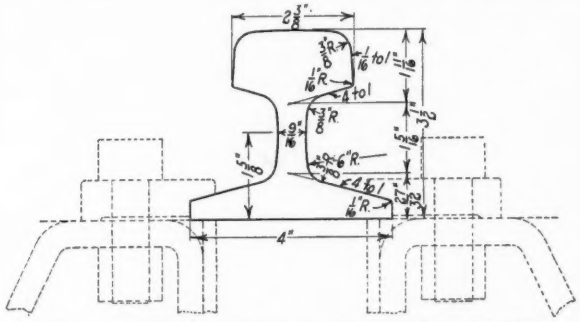
Alternative Design in Which the Rail Is Supported on a Pair of Angles

much tar or asphalt, so that it will not become brittle and break up in cold weather. Perhaps a treatment with crude petroleum would be satisfactory. A layer of felt about ⅛ in. thick, compressing to a thickness of 1/16 in. under the tightening of bolts which hold the rail, and further compressing to perhaps one-half this thickness under an engine load, would probably go far toward reducing the shock upon the concrete beneath the rail-seat. It would also lessen the noise. Insulation between any two sections of track could be accomplished by substituting insulating fiber for the felt. This insulation should extend from the rail joint to the end of the concrete block.

Thorough drainage is essential. On fills made of sand no artificial drainage would be necessary, but on other fills it should be taken care of by tile drains just beyond the edges of the slab, with frequent outlets to the side of the embankment. In cuts the drains should be placed deeper and under the cut ditches, in order to prevent ground water from reaching the track. The proper functioning of these drains is a very important matter and they should be of ample size and have good outlet facilities.

Conduits for carrying all wiring, such as telegraph, telephone, block signals and train control, can be placed in the center of the slab as shown in the cross section, or can be placed elsewhere in the section if desired.

It is not likely that such construction as here proposed would be used to any considerable extent on single track, as its cost would not, in general, be justified by the amount of traffic. Further, to build it on



A Suggested Design of Rail for Use on Concrete Slabs

a single track railroad would necessitate the construction of a temporary track to carry traffic around the section of roadbed under improvement. This feature calls for the consideration of pre-cast slabs, to be inserted under traffic. This would seem to be entirely feasible, but it is not likely that as uniform a bearing on the subgrade could be had as if the concrete were

moulded in place, which might result in a slight inequality of settlement of the pre-cast sections.

On double track, however, traffic could be diverted to the track not being improved, without undue expense or serious interruption of traffic. Under such conditions it is probable that the pre-cast section would be more expensive, even taking into account the expense due to traffic interference. It is quite possible, however, that in certain situations this would not be the case and the pre-cast method would be more desirable.

An Estimate of the Cost and Savings

The cost of a roadbed of this type will vary with the conditions existing at each installation, such as the cost of materials and labor, and the amount of traffic. The following is an estimate of the cost under average conditions, based on the assumption that the railroad company would purchase and deliver all materials and handle the diversion of traffic and that the labor of placing the concrete, including unloading materials, would be done by contract.

Estimated cost per mile of track with a concrete base				
Material, furnished by railroad company				
Rail and fastenings				
70-lb. rail, 110 tons	@	$43.00	$4,730	
5,000 rail clips, 3,200 lbs.	@	0.06	192	
5,000 bolts and nuts, 4,000 lbs.	@	0.04	160	
Transportation and storeyard expense, 114 tons	@	2.00	228	
Total rail and fastenings				$5,310
Concrete base, 18 in. thick, 0.5 cu. yd. per lineal foot				
Proportions 1: 2: 4				
Stone or washed gravel, 2,400 cu. yds.	@	1.00	2,400	
Sand, 1,200 cu. yds.	@	0.75	900	
Cement, 4,225 bbl.	@	2.20	9,295	
Structural steel, 176,000 lbs.	@	0.045	7,920	
Reinforcing bars, 105,000 lbs.	@	0.03	3,150	
Transportation (by carrier) 6,400 tons, 100 miles @ $0.007 per ton mile			4,480	
Drain tile, 5,280 lin. ft.	@	0.10	528	
Felt, 2,000 sq. ft.	@	0.06	120	
Total for concrete base				28,793
Total material				$34,103
Labor, by contract				
Removing old track			500	
Levelling ballast for sub-grade			500	
Laying tile drain, 5,280 lin. ft.	@	0.10	528	
Unloading materials, mixing, placing concrete and steel, 2,640 cu. yds.	@	3.25	8,580	
Laying rail			750	
Total contract labor				10,858
Engineering				800
Diverting traffic				3,000
Total per mile				$48,761
Estimated cost per mile of rail and accessories in present track that would be retired				
100 lb. rail, 157.14 tons	@	43.00	6,757	
Angle bars, 320 pairs, 22,400 lbs.	@	0.03	672	
Bolts, 1,280, 2,900 lbs.	@	0.04	116	
Spikes, 12,000, 7,000 lbs.	@	2.80	196	
Tie plates, 6,000	@	0.25	1,500	
Rail anchors, 1,000	@	0.25	250	
Transportation and store yard expense, 200 tons	@	$2.00	400	
Labor installing			900	
Total per mile				$10,791
Net cost per mile of track with concrete base				$37,970

The advantages that would result from a permanent track may be classified as follows:

1. Reduction in the cost of maintenance of way.
   (a) Ties, eliminated.
   (b) Ballast, eliminated.
   (c) Track labor, reduced to rail renewals and track walking.
   (d) Probably reduced wear on rails and angle bars.
2. Reduction in the cost of maintenance of equipment.
3. Reduction in train resistance, resulting in—
   (a) Less fuel consumed.
   (b) Greater tonnage per train, with fewer trains; or higher speed, with less train hours.
4. Greater safety, especially at high speeds.
5. More comfort for passengers, due to smoother riding and freedom from dust.
6. Advertising value to the early users.

The last three items have a value that is very real, although so intangible that it is obviously impossible to estimate it in money. This value would be great for roads having a large volume of high speed passenger business. The passenger traffic of today demands the highest speed compatible with safety, and the same is true of certain classes of freight. In general, track conditions are now the controlling factor in limiting speed. With a track in perfect line and surface, and with no soft spots and low joints, this would cease to be the case, and the high speeds required to compete successfully with other forms of transportation could be maintained.

Following is an estimate of the annual saving resulting from the first three of the above items on a track having a freight traffic of 30,000 gross tons per day and 6 daily passenger trains.

Estimated annual saving, per mile of track			
Assume average daily traffic as follows:			
3 tonnage trains of 3,000 tons, 75 cars	24,000 gross tons		
4 less than tonnage trains of 1,500 tons, 40 cars	6,000 gross tons		
Total freight per day	30,000		
6 passenger trains, 8 cars each			
Assume ruling grade of 0.5 per cent			
Maintenance of Way:			
250 ties at $2.00			$ 500
Ballast renewal every 10 years, 2,000 cu. yds. at $1.50 (material delivered)			300
Track labor			
Present cost, (Acct. 220) for assumed traffic		$1,600	
Less Cost with concrete base			
Labor on sidetracks, 0.5 mile per mile of main	$200		
Renewing rail, 6 year life at $750	125		
Track walking and inspection, 1 man at $1,200 per year covering 6 miles	200		
Miscellaneous labor	200		
Total		725	
Net saving track labor			875
Total saving, maintenance of way			$1,675
Maintenance of equipment:			
Present cost per day			
18 locomotives at $0.40			$7.20
760 freight car miles at $0.016			12.16
48 passenger car miles at $0.032			1.54
Total per day			$20.90
		or $7.628 per year	
Assuming a reduction of 20 per cent annual saving would be			$1,526
Fuel:			
Assuming a decrease in train resistance of 1 pound per ton, equivalent to a vertical lift of 5280 or 2.64 feet per mile.			
2000			
Total gross tonnage per day			
Freight			30.000
Passenger			1,400
Locomotive			3,600
Total			35,000
Total per year, 12,775,000 gross tons.			
Coal saved per year, 12,775 x 2.64 x 5 lbs. = 84 tons.			
Saving per mile per year, 84 tons at $5.00 = $420.			
Increased tonnage rating:			
Present train resistance	6 lbs. per ton		
Grade resistance, 0.5 per cent grade	10 lbs. per ton		
Total	16		
Assuming a decrease in train resistance of 1 lb. per ton, the total resistance would be 15 lb. per ton, and the number of tonnage trains would be reduced by $\frac{1}{16}$, or 182 trains per year.			
Cost per train mile, not including fuel:			
Train and engine men	$0.40		
Engine house service	.10		
Train and engine supplies	.10		
Maintenance of locomotive	.40		
Interest on locomotive	.10		
Total	$1.10		
Saving per year, 182 trains at	$1.10		$200
Total saving per mile per year			$3,821
Equals 10 per cent of the estimated cost.			

If ruling grades comprise 10 per cent of the division, the application of a permanent roadbed to the ruling grades only would result in a saving per mile due to increased tonnage rating of 10 x $200 or $2,000. Adding the other savings amounting to $3,621, the total saving per mile would be $5,621 or 14.8 per cent of the estimated cost. A similar estimate, based on a freight traffic of 40,000 gross tons per day shows a saving per year per mile of $4,950 or 13 per cent of

the estimated cost; and when applied to ruling grades only, of $7,434 or 19.5 per cent.

The several parts of the present track are renewed at comparatively short intervals, and it is therefore proper to deduct from the annual savings above estimated an amount sufficient to amortize the cost of the concrete base during its probable life. If this life is 50 years or more, this amount is negligible; and if the life is 35 years it is 1 per cent of the first cost, assuming interest at 6 per cent.

In the above estimate the reduction in maintenance of way expense is the only item for which there exists a reliable basis. The figure of $1,600 per mile per year used for the present cost of track labor may seem excessive to one accustomed only to figures representing average costs over an entire railway system or an entire operating division; but when the cost of track labor on the heavy traffic sections is kept separately, it will be found to be much higher than the average. The figure used is based on actual costs on the Pere Marquette, where a comparison of the cost of track labor on the different operating divisions in 1923 and 1924 indicates that such cost is approximately given by the formula:

$$\text{Cost of track labor per mile per year in dollars} = \$275 + \frac{\text{gross tons per year}}{8000}$$

It is assumed that the cost of maintaining equipment would be reduced 20 per cent. This may be either too high or too low, as there is no basis for an estimate; but it is reasonable to suppose that equipment running over a perfectly smooth track would require less repairs and would have a longer life than if subject to the innumerable shocks inherent in operation over the present type of track.

There is likewise no definite basis for the assumption of a reduction in train resistance of one pound per ton. There is doubtless a large amount of energy lost in shocks at rail joints in the present track structure; and, due to the imperfect elasticity of the roadbed, a further amount is lost in depressing the track and pushing the main track wave ahead of the locomotive and smaller ones ahead of each truck. This loss would be practically eliminated with a track of the type proposed, but the decrease in train resistance which would result can only be determined by experiment.

The conclusions to be drawn are that, for roads with heavy traffic, track of the permanent type would result in a reduction of maintenance of way expenses that would yield a moderate return on the investment cost; would probably further result in a large saving in maintenance of equipment and cost of transportation; and would permit the safe operation of trains at considerably higher speeds than are now permissible.

With a moderate return assured on the investment from the saving in maintenance of way expense alone, it would be well worth while for any road with heavy traffic to install one or more experimental sections of permanent track in order to determine its other economic values, and to develop by trial the details of a practical design.

Railways Enter New Year With Optimistic Outlook

MORE MILES of new railways were built in 1925 than in any year since 1919, while more miles of second track were built than in any year since 1913. At the same time, more miles of new lines are under construction than at the beginning of any year during the past decade. These figures and those which follow are taken from a survey of railway activities during 1925 and a forecast for 1926, incorporated in the Annual Statistical Issue of the Railway Age for January 2, 1926.

New Construction

A total of 644 miles of new lines was constructed in the United States in 1925 as compared with 578.95 miles in 1924 and 427.27 miles in 1923. Florida led all other states in the completion of lines with 99.03, although 96.72 miles were completed in Texas. The largest amount built by a single railway was constructed by the Santa Fe in Oklahoma and Texas, aggregating 123 miles.

A total of 689 miles of second track was completed in the United States last year as compared with 456.12 in 1924 and 683.99 in 1923. More than a third of the second track, or 236.5 miles, was built in Florida, principally by the Florida East Coast, while South Carolina was second with 90.27 and Ohio third with 75.33 miles.

The construction of new lines showed a decrease in Canada as compared with the two preceding years, 414 miles having been completed in 1925 as compared with 615 miles in 1924, and 655 miles in 1923. Of the 1925 total, 312 miles were built by the Canadian National and 75 miles by the Canadian Pacific. Only 3.67 miles of second track were built in Canada during the year.

Last year marked a renewal of construction activities in Mexico, 132.38 miles of lines having been built during the year, including 69 miles on the Southern Pacific of Mexico, 37.5 miles on the Western Railway of Mexico, 16 miles on the Mexicalia San Felipe and 9.88 miles on the National Railways of Mexico.

As was evidenced by the amount of first and second track built, general construction work was pursued actively during the year and showed a marked increase over previous years, both in the number of projects undertaken and the expenditures involved. While the Class I roads of the United States spent approximately $775,000,000 during 1925, or about $100,000,000 less than in 1924, this decrease was principally in equipment, orders for which declined heavily during the early part of the year. While this decrease was made good in large measure by relatively large orders placed late in the year, payment for this equipment will not be made until it is delivered in 1926. Of the appropriations authorized during 1925 approximately two-thirds were for roadway and structures.

Among the larger projects other than extensions for which expenditures were made last year were the Markham yard of the Illinois Central near Chicago, the Newark Bay bridge of the Central Railroad of New Jersey, the reconstruction by the Central of Georgia of its line between Columbus, Ga., and Birm-

ingham, Ala., the construction of large classification yards by the Florida East Coast near Jacksonville, Fla., and Miami, and substructure work on a bridge across the Mississippi river for the Sante Fe at Ft. Madison, Iowa.

Signaling and Train Control

A total of 2,938 miles of road was equipped with automatic block signaling during 1925, a larger mileage than in any year since 1914. The largest installations included 235 miles of color-light signals on the Seaboard Air Line and 207 miles on the Great Northern, 133 miles of position-light signals on the Norfolk & Western and 140 miles of semaphore signals on the Louisville & Nashville.

Ninety-two interlocking plants were placed in service during 1924, four of which were in Canada. Extensive additions were also made to 11 interlocking plants, while 76 plants were entirely rebuilt and overhauled. Highway crossing protection also received increased attention, 938 automatic protection signals being installed during the year, 329 of which were of the movable banner auto-flag type and 609 of the flashing light type. The Baltimore & Ohio led other roads with the installation of 212 signals of the latter type.

Of the 45 roads on which the first train control order of the Interstate Commerce Commission is now effective, 24 have completed their installations while three others have installed the wayside equipment. The second order, which is now effective on 41 of the 45 roads included in the first order, requires that a second division be equipped with train control by February 1, 1926. Two installations under this second order are in service and the wayside apparatus is approaching completion on three other roads. The commission made 19 interim inspections and 9 final inspections of installations during the year, rendering 14 interim and 2 final reports. Work on installations in compliance with both the first and second orders is proceeding rapidly and marked progress is expected during 1926.

Lines Abandoned

A total of 606 miles of railway lines was abandoned in the United States during 1925 while 63 miles was abandoned in Canada, as compared with 693 miles and 52, respectively, in 1924. Of the mileage abandoned in the United States, 456 miles has actually been taken up. This mileage is widely scattered and consists of a large number of relatively short lines. The three longest stretches abandoned in the United States during the year were the Manistee & North Eastern from River Branch Junction, Mich., to Grayling, 76.83 miles; the Lorain, Ashland & Southern from Lorain, Ohio, to Custaloga, 67 miles, and the Alexander & Eastern from Alexander, W. Va., to Big Run, 29 miles. In Canada the only line of any importance to be abandoned was the branch of the Maine Central from Beecher Falls, Vt., to Lime Ridge, Que., 53.06 miles.

Traffic Established New Records

During 1925 the railways established a number of new records in the handling of traffic. Among these records are the following:

The greatest freight traffic in history, measured by the number of cars loaded with revenue freight, was carried by the railroads of the United States.

This enormous traffic was handled with practically no car shortage or transportation difficulties, there having been at all times no less than 103,000 surplus freight cars and 4,200 surplus locomotives in serviceable condition.

The greatest freight traffic for any month on record was carried by the railroads in October when it amounted to 44,061,988,000 net ton miles, exceeding by 2.2 per cent the previous high record made in October, 1924.

A total of 1,124,436 cars loaded with revenue freight for the week ended on August 29 was the greatest for any one week on record, exceeding by 12,091 cars or 1.1 per cent the previous high record made during the week of October 24, 1924.

The average daily movement of all freight cars in October was 32.2 miles which exceeded by 1½ miles the previous high record.

The railroads on Wednesday, September 30, moved 1,090,693 freight cars, the greatest number for any one day in history. This included both loaded and empty freight cars.

The average load of freight per train for the month of August was 796 tons, the highest ever attained, being an increase of 26 tons over the previous record made in October, 1924.

Less fuel was consumed during the year in proportion to the amount of freight traffic handled than ever before. For the first 10 months in 1925 an average of 138 lb. was used to move 1,000 gross tons of freight and equipment one mile, compared with 148 lb. in 1924 and 160 lb. in 1923.

The net operating income of the Class I roads of the United States was approximately $1,125,000,000, a return of about 4.8 per cent on their property investment. This compared with 4.33 per cent in 1924 and 4.48 per cent in 1923.

The amount of equipment ordered by the railways, and also the amount built for them was less in 1925 than in 1924. The number of new locomotives ordered was 1,055, as compared with 1,413 in 1924, and the number of new locomotives built for them was 994, as compared with 1,736 in the previous year. The number of new freight cars ordered in 1925 was 92,816, as compared with 143,728 in the previous year, and the number built was 105,935, as compared with 113,761 in the previous year. The number of new passenger cars ordered was 2,191, as compared with 2,554 in 1924, and the number built was 2,363, as compared with 2,151 in the previous year. The railways ordered 149 rail motor cars and 125 motor busses.

The Outlook for 1926

Information furnished the Railway Age by railways representing approximately one-half the mileage of the United States and Canada indicate that these roads will spend between $750,000,000 and $900,000,000 for capital improvements, exclusive of current repairs and maintenance, this year. In addition, the roads have carried over from 1925 unexpended appropriations aggregating more than $400,000,000, including such work as the completion by the Illinois Central of the new line between Edgewood, Ill., and Fulton, Ky., which will involve a total expenditure of $20,000,000, the completion of the Port Richmond (Philadelphia) grain elevator, a car repair shop at Reading, Pa., and other work amounting to more than $7,500,000 by the Reading, the completion of more than 320 miles of new lines by the Southern Pacific in Oregon and Arizona, etc. Work carried over by other roads runs into large sums, aggregating more than $31,000,000 on the Pennsylvania, $20,000,000 on the New York Central and $25,000,000 on the Santa Fe. Among the larger budgets for 1926, including carry over, are those of the Atchison, Topeka & Santa Fe, $55,000,000; the Southern Pacific, Pacific system, $44,328,000; the Illinois Central, $41,384,900; the Union Pacific, $36,100,000; the Florida East Coast, $22,750,000; the St. Louis-San Francisco, $21,000,000; the Chicago, Rock Island & Pacific, $20,994,286 and the Louisville & Nashville, $20,000,000.

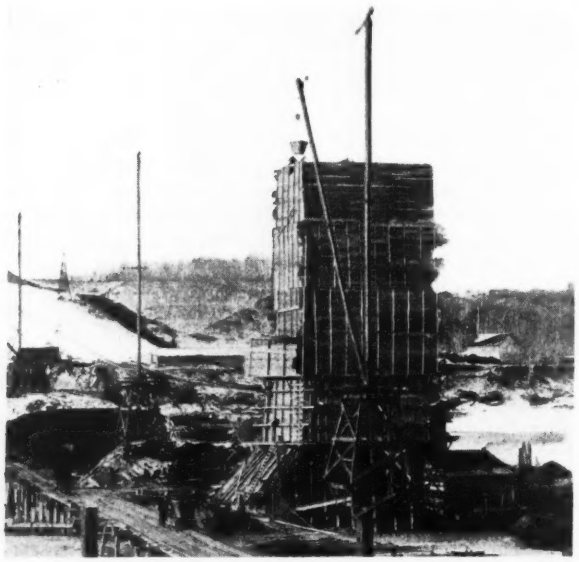
Of the total amount to be spent it is estimated by the Railway Age that $50,000,000 will go for new lines; $15,000,000 to $20,000,000 for multiple main tracks; $50,000,000 for improvements in shops and other equipment; $15,000,000 for signaling and train control and $150,000,000 for miscellaneous work.

Winter Concrete Must be Kept Warm*

Heating of the Aggregates and Water Should Be Followed Up with Precautions Against Freezing in the Forms

By A. M. BOUILLON
Engineering Department, Chicago Terminal Improvements, Illinois Central, Chicago

HEATING MASS concrete placed below ice level in river piers or below ground level in land piers and abutments is usually a simple matter as the coffer dams or the walls of the excavations provide excellent protection against winds and loss of heat, leaving only the top to be covered, which may usually be accomplished satisfactorily with tarpaulins supported upon planks laid over the cross bracing of the foundation opening. The tarpaulins



Winter Concrete Work, a Pier Enclosed in Housing

should be lapped to provide convenient temporary openings for lowering the concrete buckets.

The space below ice or ground level can be heated by means of stoves with little danger from fire and this was the usual practice on work with which the writer has been connected. Stoves were provided both outside and inside of the forms, the latter being supported upon movable brackets that were raised as the surface of the concrete was brought up. Protection against fire from such causes as sparks getting on the tarpaulins below either ice or ground level was afforded by drifted snow banks within convenient shoveling distance. Barrels full of water and fire buckets were also kept in the sheds that housed the hoists. The greatest danger from fire is during blizzards, but this risk is far greater in the portion of the pier above ice or ground level than in that below the surface. Water in barrels may also be kept in the excavation outside of the forms for wetting the forms.

For the portions of the piers or abutments rising above the surface the best protection is afforded by housing built around the structure, leaving a space about 2½ ft. wide outside the forms in which steam radiators may be installed. In constructing the high piers on the North Saskatchewan River bridge, landings were provided at vertical intervals of about 12 ft. on which radiators were placed, each controlled by valves to insure a suitable supply of heat and moisture. As a result of experiments it was found that the ideal curing condition for concrete was a moist atmosphere at a temperature ranging between 50 deg. and 60 deg. F. To offset danger of rapid cooling of the top concrete exposed to the cold air when portions of the tarpaulin covers had to be removed for the lowering of concrete buckets, emergency heaters were placed on movable brackets fastened on the inside of the forms but these heaters were used only during periods of extreme cold and blizzards.

Tested minimum-maximum thermometers were placed inside of the forms at each landing. These enabled the inspectors to watch the temperature of the concrete closely during the entire construction period with the object of preventing overheating as well as chilling or freezing.

The housing usually provided is constructed of 1-in. T & G boards laid over 2-in. by 4-in. or 2-in. by 6-in.

A Later View of the Same Pier After the Forms and Housing Had Been Removed

studs spaced 2½ ft. apart, the outside being covered with two thicknesses of good building paper fastened with battens. Ladders are provided for communication between landings with other ladders on the outside of the housing to serve as fire escapes. Construction such as this will permit the conduct of work in the coldest of weather.

On the North Saskatchewan River bridge there

*This is the third of a series of articles on building bridge masonry in winter. The first article appeared on page 383 of the October, 1925, issue and the second on page 485 of the December issue.

were several spells during which the temperature descended to 40 deg. F. below zero, with one extreme of 68 deg. F. below. But the work on this job was carried on by day and night shifts regardless of the weather, except for occasional short delays during severe blizzards when it was impossible to see. A comparison of the costs showed that under the conditions encountered on this work, the winter construction of cofferdams and concrete was decidedly cheaper than summer work with practically no difference in the cost of excavation. Below are some figures on the net cost of housing and heating on this project, allowing deductions for salvage obtained after completion.

Cost of heating the portion below ice level (no housing required) per cubic yard of concrete:	
Heaters	2.00 cents
Coal at $2.73 per ton	0.80 cents
Labor	2.90 cents
Total, below ice level	5.70 cents
Cost of housing and heating the portion above ice level, per cubic yard of concrete:	
Housing, allowing for re-use of sections	15.32 cents
Heating plant, including rental for boiler	7.95 cents
Coal delivered to boiler at $2.73 per ton	3.28 cents
Proportionate time of fireman and labor, cleaning boiler	3.60 cents
Total, above ice level	30.15 cents

Wages were 30 cents per hour for firemen, 28 to 32 cents for carpenters, and 20 to 25 cents for laborers. The average cost of the lumber delivered (of the grades used) was $30 per M. ft. b. m.

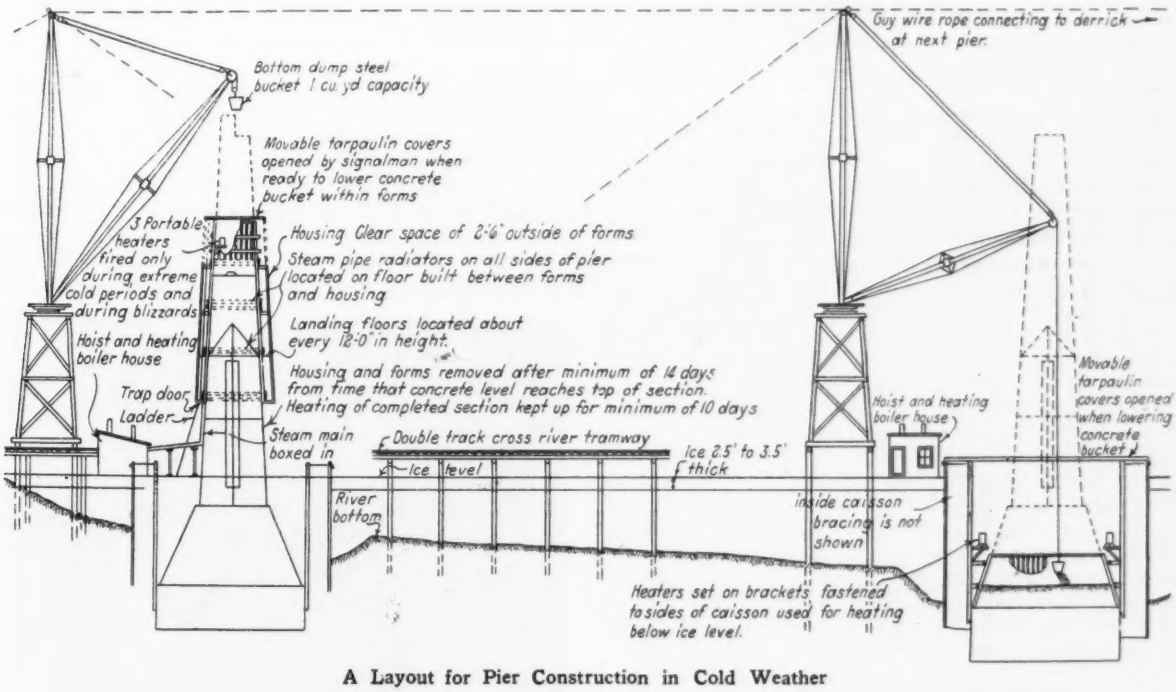
The total average cost of heating winter-placed concrete, including the portion placed below the ice level, was 20 cents per cubic yard. Adding to this figure the cost of heating aggregates, namely 12.88 cents, detailed in the article appearing on page 485 of the issue of December, 1925, brings the total average cost of heating up to 32.88 cents per cubic yard for heated concrete in piers. Under present average conditions this would probably amount to about 65 to 70 cents per cubic yard. The steam was supplied by a 10 or 12-hp. boiler at each pier, installed under the same roof as the hoists, the exhaust steam from the hoists being also utilized.

A cheaper form of housing which has been used successfully where winter conditions were less severe than in the case cited above consisted of heavy canvas cut and sewed to fit over a frame built around, but at some distance outside the forms. This was the type used on the north river pier of the Susitna bridge on the Alaska railway, built in the late fall and early winter of 1920, a period during which the temperature fell to approximately 25 deg. F. below zero.

Other types include unit frames covered with canvas or boards which may be moved from one pier to another. In some cases considerable fitting and caulking may be required to keep the warm air in, particularly in districts exposed to severe cold. The heating of bridge pedestals on a large viaduct job presents opportunities for economy in planning a type of housing that can be built in standardized panels that can be re-used throughout the work.

Protection for Concrete Building Work

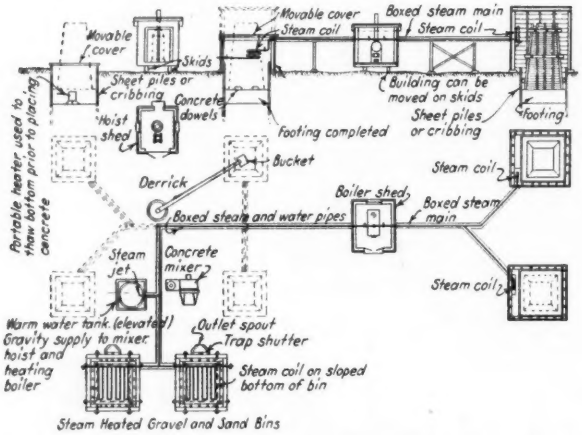
In addition to the above mention should be made of the practice followed particularly on concrete building construction in cities, of enclosing one or two stories with large pieces of canvas that are allowed to hang more or less loosely along the outside of the forms, the heating being provided by salamanders located inside of the walls. This system is probably somewhat risky, particularly in localities normally enjoying mild winters but which are occasionally subject to sudden blizzards or very cold spells. The failure to provide heat on the outside of the walls exposes a vulnerable front to the attack of frost. This system also results in dehydration of the concrete, particularly when the forms are removed too early and when no curing is provided, this excessive drying is intensified on the inside face of the wall exposed to the direct heat of



A Layout for Pier Construction in Cold Weather

the stoves, and results in materially reducing the strength of the concrete.

In certain cases it is more practical to use stoves or salamanders inside of the housing but only because the size will not warrant the installation of a steam heating plant. This applies to small foundation work where no steam is used on the job. If boilers are installed for pumps or hoists it may not be as economical to provide coils for heating, but it will certainly



Portable Housing Protection for Viaduct Pedestals or Other Small Units

be safer on account of the danger of fire starting from stoves or salamanders, particularly during strong winds. The writer has seen such fires occur on several occasions.

Heating with stoves or salamanders is also objectionable because of the drying effect on the concrete. Steam can be allowed to escape so as to keep the forms damp, while the opposite condition results when stoves are used. If stoves are employed the forms should be sprinkled frequently, or better still when water pressure is available, a small stream of water should be allowed to flow from a pipe placed on top of the concrete, starting about 18 hours after placing and continuing throughout the full period of heating and curing so as to insure constant saturation of the outside faces. This prevents evaporation of water from the concrete and insures as complete hydration as the other elements of the mix will permit.

A very effective scheme for combined heating and curing which is particularly applicable to mass concrete work where winter climatic conditions are not severe and where both water supply and drainage facilities are ample, is to have a stream of warm water flow over the structure from the time the concrete has set until the curing is complete. The structure should, of course, be housed except in districts subject only to light night frosts.

Attention to Curing Is Important

As pointed out in a previous article published in *Railway Engineering and Maintenance* for August, 1925, the curing of concrete built during any season, including winter, is a very important function of concrete production and one that should never be overlooked. Dependable tests made by several American and foreign investigators on a practical working basis have proved that curing is the only insurance against a marked loss in the potential strength of concrete, as mixed and placed in the forms, which results from the escape of the moisture needed during the process of hydration. This loss is frequently carried even further by the too early removal of forms and by heating with stoves, salamanders, or other dry systems of heating. These or any other conditions conducive to rapid evaporation should invariably be compensated for by proper curing methods such as recommended in that article or any other method that is found equally efficient.

It is fortunate that the concrete specifications in general use provide for comparatively low unit stresses, but even under such conditions the leaks due to improperly waterproofed joints and the conspicuous cracks that sometimes appear soon after completion of the work and for which there can not, in many instances, be any logical excuse are usually evidences of poor constructions, although aggravated in some cases by faulty design. Even though it might be assumed that the factor of safety is sufficient to insure stability and still permit of certain deviations from specifications covering mixing and placing, and the elimination of curing measures, there is no valid reason for failure to use available information, which if properly applied, will increase the strength of the concrete from 50 to over 100 per cent at an added cost probably not exceeding one per cent.

Delivering and Placing Concrete in Winter

Apart from heating the aggregates and heating the placed concrete, it is necessary to provide a system of delivery from the mixer to the forms that will be consistent with the other precautions. The heat stored in the concrete through heating the aggregates or water or both, should be preserved as far as possible during the period of transit, to insure the placing of the concrete in the forms without danger of causing deceleration in the natural schedule of setting and hardening. These conditions will consequently exclude the use of tower and chuting systems while winter conditions prevail, replacing these by a method that will provide as short an exposed transit as conditions of the job will permit. It must also make possible the delivery of each batch in a consolidated mass as in cases where the concrete is dumped from the mixer

An Example of Frozen Concrete

into small cars, bottom dump or side tilting dump buckets and push carts, which, in the case of mass concrete permit the batch to be delivered and placed directly in the forms either by derrick, cableway, truck, dump cars on a track or carts pushed by hand.

Within forms that are too narrow to permit the low-

ering of buckets, or the direct dumping of bulk delivery measures, any of the transport methods mentioned may be readily used by dumping the concrete into an inclined box trough or hopper located within the housing, from which it can be chuted into the forms at any rate of flow desired. This box trough can be located either on skids over which it can easily be slid between the receipt of batches, or, in the case of a large job, it may be carried on a four-wheel truck moved over fixed rails.

All Parts of Plant Should Have Same Relative Capacity

It is important to gage the size of the mixing and delivery plant by the size and conditions of the job. For instance, mass concrete such as in dams, large bridge piers and abutments, large mass retaining walls, etc., where the concrete may be either lowered in buckets or chuted direct into the forms will make it advisable to provide large mixers and delivery equipment proportioned thereto The size of the whole plant should be relative in order to provide against waste of effort, loss of time and the resulting unnecessary expense. The dump buckets, or cars, etc., used for delivery should be of approximately the same capacity as the mixer. The other equipment, such as derricks, hoisting engines, chutes, dumps, etc., should conform as nearly as practicable to the requirements of the job. On smaller jobs, such as the construction of thin walls and general reinforced concrete work, small mixers with lighter delivery equipment should be used. In winter this will permit lighter framing for the platform supporting the box trough where the concrete is to be rehandled. The above recommendations, while applying to conditions the year round, are particularly pertinent to winter construction.

Concrete should never be poured over frozen ground, as in foundation footings, pavements, etc. Therefore, it is essential that the bottom of the excavation be kept from freezing. As soon as the excavation is completed, proper heating should be maintained with stoves or salamanders and the top of the hole covered so as to preserve the heat, until ready to place concrete. If the ground has been allowed to freeze it can be thawed out by the generous use of steam jets, after which the softened top should be scraped off and removed. The excavation should then be kept warm until concreting is begun.

Railroads Report Results of Annual Track Inspections

SUPPLEMENTING the reports of the annual track inspections of the Pennsylvania, the Southern and the Norfolk & Western, appearing on page 496 of the December issue, information is given below concerning the award of prizes and records made in the annual track inspections carried out late last year on the Lehigh Valley, the Erie and Pere Marquette.

Lehigh Valley

The Lehigh Valley does not award prizes but the engineer maintenance of way arranges for the preparation of a complete statement of the results of the annual track inspection in the form of tables detailing and summarizing the grades marked for each section, supervisor's district and division on the system. The grades in each case represent the sum of the marks accorded for various features entering into the condition of each subdivision of the road, the highest or perfect grade in each case being as follows: surface, 35 per cent; line, 35 per cent; ties, 8 per cent; anti-creepers, insulated joints and joint bolts, 6 per cent; ballast, 6 per cent; drainage, 6 per cent, and general appearance, 6 per cent, making a total of 100 per cent.

The highest average obtained by any division was 99.30 per cent, given to the New York division. The Seneca division came second with a mark of 99.12 and the New Jersey and Lehigh division was third with a standing of 99.00. Among supervisor's subdivisions, the subdivision in charge of C. Hewett, on the Seneca division at Sayre, Pa., received a grade of 99.32. The subdivision in charge of J. Sheehan, on the New Jersey division at Jersey City, N. J., was rated second at 99.30, and the subdivision in charge of E. F. Dinan, on the New Jersey and Lehigh division at Easton, Pa., third with a grade of 99.23.

Section No. 58 on the Seneca division, at Ithaca, N. Y., received the highest rating on the system, 99.84. Section No. 9 on the New Jersey and Lehigh division was second with 99.83, and section No. 8½ on the same division was third with 99.79, both sections being at Royce Valley, N. J. Section No. 65 of the Seneca division, at Geneva Junction, N. Y., and section No. 42 at Wyoming, N. Y., on the Buffalo division, tied for fourth place with grades of 99.77.

Erie Uses Track Inspection Car

As in previous years the Erie based its award of prizes primarily on the findings of an inspection trip over the entire system under the direction of the engineering assistant to the operating vice-president, the primary feature of this inspection trip being the use of a track inspection car which records low joints, gage, cross elevation, lurches, time and location, these automatic records of the car being supplemented by personal inspections of the alinement, policing, ballast line, fence conditions, etc. Prizes of $200 and $100 were given to the supervisors on each of the three regions of the Erie whose subdivisions received the highest and next highest gradings. In addition, banner section prizes of $150 were given to the foremen whose sections received the highest mark on each division while prizes of $100 and $50 were awarded the foremen whose sections were given the first and second rating on each subdivision.

As in past years a special prize of $100 was given to each supervisor over whose subdivision the inspection car was operated without recording a low joint (a depression of ⅜ in. or more). The subdivisions of 24 supervisors met this test satisfactorily so that $2,400 was awarded in prizes for this feature of the inspection alone. As a result of the interest aroused by this feature of the system of awards particular efforts have been made to meet this requirement successfully and as a result low joints on the Erie have been reduced from 33.3 per mile in 1908 to 0.06 per

mile in 1925. Winners of the supervisor and banner section prizes are tabulated below.

New York Region, Main Line

Supervisors' Prizes

Division	*Name*	*Amount*
New York	J. R. MacAsy	$200
Delaware	W. J. Weecheider	100

Banner Section Prizes

Terminal & New York	F. Vacca	$150
Delaware	M. J. Cuddihe	150
Wyoming	C. Cromlich	150
Susquehanna	Charles Hall	150
Buffalo	D. Belurgi	150

New York Region, Branch Lines

Supervisors' Prizes

Greenwood Lake	C. L. Connors	$100

Banner Section Prizes

Greenwood Lake	A. Blondina	$150
N. Y. S. & W.	R. Sarno	150
Rochester	T. Tucci	150

Ohio Region, Main Line

Supervisors' Prizes

Mahoning	J. Lyman	$200
Meadville	P. F. Nichols	100

Banner Section Prizes

Ally. (River line)	R. Tapp	$150
Meadville	P. H. Corbert	150
Mahoning	N. Truce	150

Chicago Region, Main Line

Supervisors' Prizes

Kent	G. L. Benson	$200
Marion	C. Foglegreen	100

Banner Section Prizes

Kent	J. A. Bryan	$150
Kent	A. N. McIntire	150

Supervisors and Foremen Receive Prizes on the Pere Marquette

As a result of the annual track inspection on the Pere Marquette a prize of $100 was awarded to William O'Brien, supervisor on the Toledo division, with headquarters at Toledo, Ohio, whose subdivision received the highest rating on the road, 90.42. A. Gustafson, supervisor on the Petoskey division, with headquarters at White Cloud, Mich., received a prize of $100 for the subdivision showing the greatest improvement as compared with the previous year. His rating in 1925 was 88.43, as compared with 84.24 in 1924. The following foremen received prizes of $25 for the sections receiving the highest rating on their respective subdivisions:

Foreman	*Headquarters*	*Condition*
George Sulkers	Holland	88.71
Charles Kreiger	Grand Junction	91.24
Huson Ruggles	Montague	89.78
Edward Gustafson	White Cloud	90.86
Charles Sexton	Bellaire	91.30
George Wilkins, Sr.	Williamston	90.30
Frank King	Sombra	89.30
Frank Dunn	Grand Blanc	92.22
Joseph Mentel	Erie	91.94
Charles Peterson	Lake	90.17
Ralph Ward	Avoca	88.40
Jesse Ellison	Fairgrove	91.66
William Chudley	Mecosta	91.73

The foremen named below received prizes of $25 for the section on each track supervisor's subdivision showing the greatest improvement for the year:

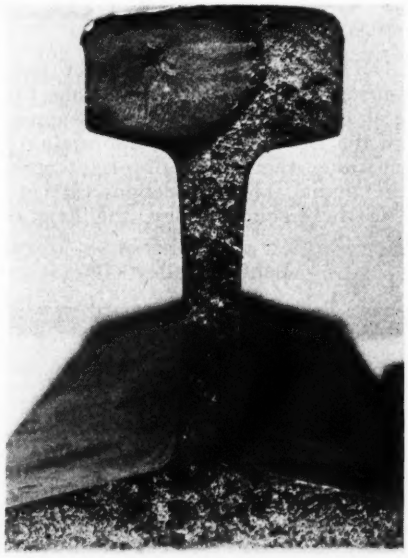
Foreman	*Headquarters*
Ed Sonnenberg	Michigan City
F. W. Brouwer	Shelby
Thomas Olsen	Twin Lakes
C. M. Smith	Alden
Louis Luksche	South Lyon
Orville Brush	Wheatley
Earl Keely	Flint
Clayo Bushroe	Carleton
Herman Kumbier	Saginaw
Paul Filwock	Croswell
Paul Kosanke	Bay Port
Steve Arnold	Edmore

Fissure Causes Bad Accident

AS NOTED briefly in the general news columns of the December issue, the derailment of train No. 104 of the St. Louis-San Francisco near Victoria, Miss., on October 27, resulted from a transverse fissure rail failure. The rail was of 90-lb. A. S. C. E. section rolled at the mill of the Tennessee Coal, Iron & Railroad Company at Birmingham, Ala., in October, 1918, and laid in track in April, 1919.

This rail was inspected by the Robert W. Hunt Company at the time of manufacture and the records of this company show that the chemical composition of the heat from which the rail was rolled conformed to standard specifications and that all of the rails from the heat, 180 in number, were accepted. The rail which failed, which was 33 ft. long, was a "G" rail well removed from the top of the ingot. It broke 13 ft. 8 in. from one end. The transverse fissure, as shown in the illustration, extended to within 1-32 in. of the surface on the gage side of the rail and to within 1-16 in. of the top. Being thus entirely surrounded by sound metal it was impossible of detection prior to failure.

As is also indicated by the photograph the rail was not worn appreciably. The track conditions were exceptionally good, so that the rail was not receiving undue punishment by reason of inadequate maintenance. The train involved in the derailment was traveling north and the accident occured on a tangent



The Fissure Extended Almost to the Surface of the Head on the Gage Side

2,300 ft. north of the end of the nearest curve on a one per cent descending grade. The roadbed at the point of accident was on an embankment about 19 ft. wide and the track was laid with 20 ties per 33 ft. panel with one foot of Birmingham slag ballast under them. A careful examination of the 2,300 ft. of track approaching the point of derailment showed only 13 ties that could be classed as defective in any way, or less than one per cent of the total number of ties, and no two of these occurred in the same panel of track. Even these ties were not decayed to the extent of warranting their removal from track and were considered good enough for more than a year of service. The track was fully tie-plated and spiked.

B. R. & P. Demonstrates Economy of Tie Preservation

Fifteen Years' Study Shows Advantages of Treating Native Hardwoods with Full-Cell Process

By E. F. ROBINSON
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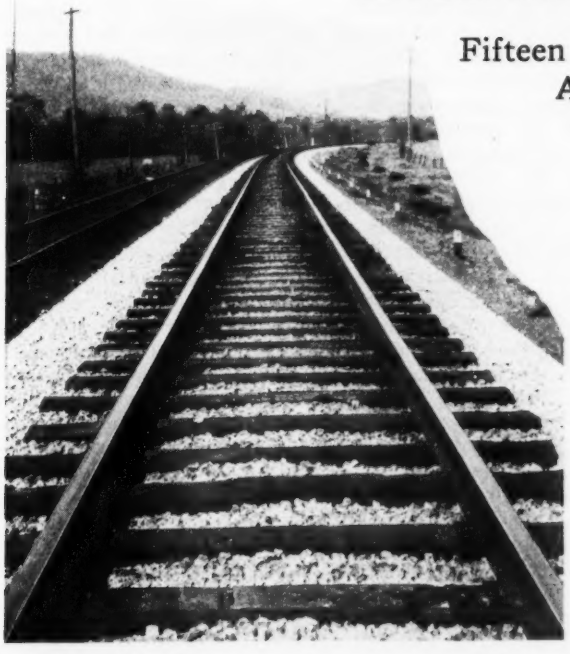


PRIOR to 1910 no treated ties were used on the Buffalo, Rochester & Pittsburgh and the ties were of yellow pine from the South, and white oak from West Virginia and from points local to the line in Pennsylvania. The increasing price and uncertainty of the tie supply led to favorable consideration of the establishment of a timber preserving plant to treat all cross and switch ties, and such bridge timber, including piling, and other timber as might be required for miscellaneous use. It was the expectation, which has been practically borne out, that the operation of an independent timber preserving plant, located on the line of road would result in building up a continuous supply of local ties and that the treatment of ties would make it possible to use successfully beech, maple, red oak and other kinds of timber which, without treatment, are unfit for cross ties.

A careful study of the entire situation was first made, consideration being given to the available supply of ties, class of timber to be treated, location of plant, design of plant and capacity, character of treatment, storage and dstribution, protection of ties after treatment, and records.

The Timber Available for Ties

A survey was made of the standing timber in the territory within several miles on each side of the line, which pointed to the conclusion that there would be no difficulty in securing sufficient ties of beech, birch, maple, red oak, pin oak and others of the red oak family to meet the requirements for years to come. The former practice had been to accept ties 8 ft. 6 in. in length and of various sizes, both sawn and hewn but in order to secure uniform treatment and uniform spacing of ties in the track it was decided to revise the specifications for ties to be treated and accept locally only ties sawn on four sides, 7 in. by 8 in. by 8 ft. 6 in. and continue to accept hewn Southern pine ties 7 in. by 9 in. by 8 ft. 6 in.

With the thought in mind that if decay has once started, preservative treatment cannot restore the timber to a condition of soundness and that money spent in treating timber which has even incipient decay is largely thrown away, great care has been taken in the selection of ties for treatment, excluding all which show any evidence of decay. Great care has also been taken in piling the ties, both on the right of way and at the timber preserving plant to avoid any condition favorable to decay or fungus growth. The first year after commencing to accept beech, birch, maple and other hard wood ties for treatment it was found that under certain conditions fungus growth appeared on the ties if they were allowed to remain piled on the right of way at the place of delivery for any great length of time. Dealers are, therefore, required to load all ties for shipment to the timber preserving plant as fast as they are delivered and inspected, with the object of having the ties properly piled at the plant for air seasoning under careful supervision of the organization.

Some time was required to work out with the tie dealers and to enforce our present rigid specifications for ties to be treated but this was finally accomplished and up to the end of 1916 a local supply of ties sufficient to meet requirements, for both construction and maintenance, had been built up. In 1917, however, conditions changed rapidly and the supply of local ties practically stopped, due largely to labor shortage and war conditions and it has been necessary to rely largely upon sap yellow pine ties purchased in the South for construction and maintenance requirements since 1916. This condition is, however, gradually improving and it will doubtless be possible to bring back the tie supply to points on the line and tributary to it within the next few years.

The Treating Plant

It was considered advisable to locate the timber preserving plant at a central point on account of distribution and as suitable land was available at Bradford, Pa., it was decided to locate it at that point, which is a fairly central location. While a large portion of the ties to be treated come from the south end of the line, making it necessary to back-haul treated ties for the territory south of Bradford, this does not work any hardship as empty cars on the way to the mines are loaded with ties, which avoids back-haul of empty equipment.

The plant, which has one treating retort, 98 feet long, with a capacity of about 250,000 ties per year, was erected and put in service during the summer of

1910 at a cost, including tracks but not including land, of $70,000. Improvements to the amount of $30,000 have since been added, consisting principally of the extension of tracks to serve the storage yards. In laying out the plant, careful consideration was given to the location and design of loading platforms, the provision of adequate space for tie storage with good air circulation for seasoning and water supply for fire protection.

After investigating the different methods of treatment throughout the country it was decided to adopt the full cell creosoting process on the basis of ten pounds of creosote oil per cubic foot of timber as being most likely to prove economical, having in mind the injection of sufficient creosote into the ties to preserve them for a long period; the full effect of this treatment to be insured through proper handling and protection of the ties against mechanical wear after treatment. The record of results so far obtained, which is referred to further on, fully justifies this practice.

For the first two or three years after the plant was put in operation a considerable variety of ties was accepted for treatment, including beech, birch, maple, red oak, pin oak and others of the red oak family, cherry, hickory, sycamore, chestnut, elm, etc., but finally as a result of careful investigation and experience it was decided to accept for treatment only beech, maple, red oak, black oak, pin oak, water oak and others of the red oak family, hickory, cherry and also yellow pine sap ties from the South, the local supply being made up mostly of beech, maple, red oak and pin oak.

The Storage and Distribution of the Ties

As previously noted, it was found advisable to have all ties which are to be treated shipped to the plant for storage and seasoning as fast as they are delivered. These ties are piled in standard piles and are seasoned from six to eight months, mainly the latter period. Various original and independent tests and studies have been made from time to time to determine the rate of seasoning of different woods under varying conditions and the effect of steaming on subsequent air seasoning. The results of these studies will be found further on in the report. It is the aim so far as practicable to have a year's supply of ties on hand; that is, the ties purchased in the summer and fall for use during the following year are piled up for seasoning and are treated through the fall and winter months as fast as they are ready. The different classes of timber are separated into groups as they are unloaded or as they are loaded on trams, grouping being made according to the manner in which the timber will take treatment as experience, tests and studies in treating have demonstrated. All hardwood ties which show any indication of checking are protected with check irons to prevent splitting, the irons usually being driven into the ties immediately after they are unloaded and piled for seasoning. It was found from experience that under certain conditions fungus growth or stain would appear on the ends of ties, particularly maple, when piled for seasoning at the timber preserving plant. When such ties were cut it was found that decay had started in the interior. In order to overcome this trouble the practice was adopted of painting the ends of all hardwood ties with hot creosote as soon as they were piled at the plant for seasoning.

In order to make room at the plant for storage, some of the treated ties are shipped out during the fall months to be piled on station grounds, where they can be easily loaded by the section men for distributing in the spring. During the summer months the piles of treated ties on the right of way are covered with a layer of earth to prevent rapid drying out but during the winter months these piles are left uncovered.

Piece work rates are paid for unloading ties for storage or direct to tram cars for treatment, and for adzing ties; all hewn ties being adzed before treatment. The sawed ties are not adzed as this is not considered necessary. Treated ties are handled by a locomotive crane in slings direct into cars or storage place as the case may be, this work also being paid for on a piece work basis.

Extreme care is taken in the handling and protection of ties after treatment. In beginning the use of treated ties it was found necessary to start a campaign of education among the track men as to the proper handling and protection and to guard against any kind of damage which would tend to shorten the life of the ties. Very careful handling of treated ties is required and the practice of throwing them over the sides of cars on top of each other in piles is forbidden as well as the practice of throwing them down embankments promiscuously when distributing them for renewals. The use of tongs is required in pulling ties into the track and the use of shovels, picks or any other tools for this purpose is strictly forbidden. The use of spike mauls or other tools for "bucking" the ties around in the track is also prohibited.

As sawed ties generally do not require adzing for the tie plates and as hewn ties are adzed at the plant before treatment, it is not necessary for the track men to use an adze on them when they are originally put in track, but as the tie plates settle into the ties it is necessary to adze them to some extent when laying new rail, regaging, or rolling rail in on curves.

Every treated tie placed in the track on tangent or curve, is plated with Goldie shoulder tie plates, the size of the intermediate plates being 5/8 in. by 7 in. by 9¾ in. and the joint plates being 5/8 in. by 7 in. by 10 in. These plates are applied to the ties, using the Ware tie plate gage and surfacer before the ties are placed in the track. The main tracks, both tangent and curves, are now almost 100 per cent tie plated. When it is necessary to pull spikes, the holes in treated ties are plugged with creosoted tie plugs and hot creosote is poured into the spike holes before driving the plugs, the man driving the plugs being provided with goggles to avoid injury to his eyes. When it becomes necessary to adze treated ties the cut surfaces receive a brush treatment of hot creosote oil immediately. Any treated ties damaged by derailments are adzed off immediately and given a brush treatment of hot creosote on the adzed portion. The object of all these precautions is to prevent, so far as is possible, the breaking of the outer treated shell which protects the interior of the tie.

Considerable time has been required to educate track men to this extent and constant attention is still required to enforce the rules. It is evident, however, that proper protection of treated timber is required if a long life is to be secured and unless this protection is afforded the high cost of treatment in the first place is not justified.

Complete Records Are Kept

A complete system of records and accounting is in use at the timber preserving plant, records being kept in detail of the treatment and disposition of every run of ties and timber. Records are also kept of all experiments made to determine the time required for seasoning, proper grouping, amount of absorption and other factors upon which the successful treatment of ties

largely depends. In fact, a complete history is kept of every run from the time the ties arrive to the time they leave the plant.

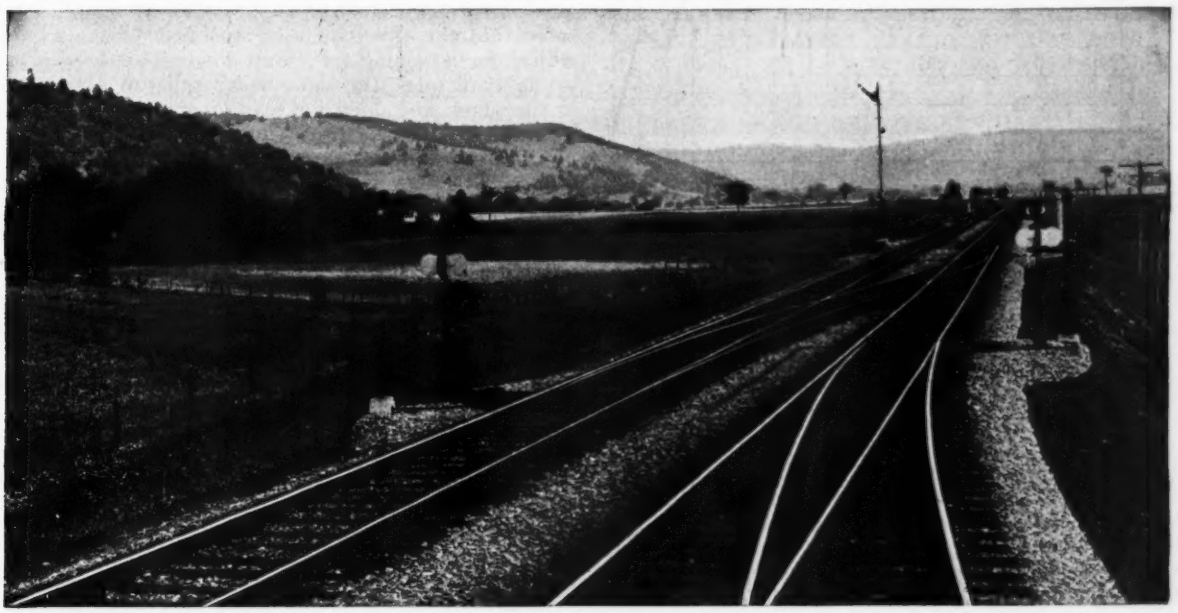
In order to have a continuous record of the service of treated ties, a galvanized nail indicating the kind of wood is applied to each tie at the timber preserving plant and when the ties are placed in the track a dating nail, showing the year put in track, is also driven into the tie. Section foremen are required to submit daily reports showing the number of ties of each kind of wood put into the track between each mile post and a book record taken from these cards is kept in the office of the chief engineer. When treated ties are taken out of track for any cause whatsoever, the foremen are required to make a report, giving sufficient data as regards location, etc., to make it possible to trace out the life of the ties removed.

Ties Removed Are Carefully Examined

All treated ties taken out of track for any cause whatsoever, unless they are entirely destroyed, are shipped immediately to the timber preserving plant for inspection by the superintendent of the plant and the engineer maintenance of way. With each shipment of such ties the superintendent of the plant is furnished with a complete history of the ties removed, including location, kind of timber, date removed, reasons for removal, etc. Any such ties that, upon inspection at the plant, are found to be fit for further use are turned over to the roadmaster at Bradford for use in side tracks at selected locations and a record is kept so that their life may be followed up.

The timber preserving plant has now been in service 15 years and there are in track approximately 1,800,000 treated ties, including cross ties and switch ties, and about 200,000 ties treated with zinc chloride which are not discussed in this report. Most of these ties are in our main tracks and important branches which tracks are now approximately 75 per cent tied with creosote treated ties. The first and second years after the plant was put in service, on account of the shortage of ties, it was necessary to treat some ties, mainly beech and maple, before they were thoroughly seasoned and a few of these ties are now showing some evidence of decay. The proportion of treated ties so far taken out of track on account of decay is, however, practically negligible.

For a number of years prior to the installation of the timber preserving plant a method of tie inspection before renewal was worked out and has been followed ever since with gratifying success, resulting in uniformity, economy and a better distribution of ties throughout all tracks. Early in the spring special tie inspectors, reporting direct to the division engineers, go over the line and mark all ties for renewals and ties are not distributed for renewals until this inspection has been made. The inspectors are required to do their work independently of the judgment of the section foreman or the roadmaster but the foreman is required to accompany the inspector to point out to him any local conditions which should properly influence his judgment in marking ties. After the inspection has been completed the inspectors follow up the work of renewing ties throughout the season, checking the ties removed against the inspection and seeing that treated ties are properly dated and that all other requirements as to the use of treated ties are fully lived up to. These tie inspectors are men who have been trained as section or extra gang foremen and are selected as inspectors on account of their ability and fitness for the work.

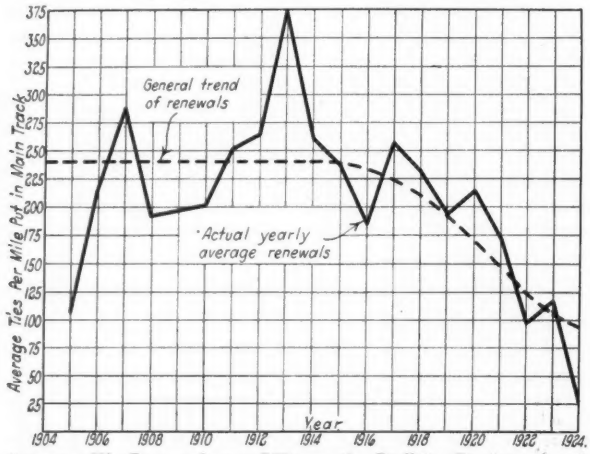


Main Tracks of the Buffalo, Rochester & Pittsburgh, near Ellicottville, N. Y.

Care Taken to Insure Uniformity of Treatment

When the treatment of ties was begun in 1910, in spite of the fact that there was already a considerable amount of technical information available, it was realized that independent tests and studies would have to be made upon which to base a practice and method most suitable to local needs. The importance was also realized of determining accurately the success of the treatment of the different varieties of ties available from their actual service records. In view of the fact that the Buffalo, Rochester and Pittsburgh is a comparatively small railroad, resulting in the possibility

of distributing treated ties with considerable uniformity in all main tracks, it was determined to keep an accurate record of the life history of each individual tie treated and put in track rather than to base conclusions upon results obtained in comparatively short stretches of test track. In other words, due to the size of the line and other local conditions, the entire main track of the railroad may be considered as test track. We have been very successful in having all treated ties put in track under practically uniform conditions, which is a necessary requirement not only to insure reaping the utmost benefit from the practice



Average Tie Renewals per Mile on the Buffalo, Rochester and Pittsburgh from 1905 to 1924

of treating but to make possible an accurate comparison of the success of treating and using various different kinds of timber under normal service conditions, which are affected by climate, ballast, drainage, weight of rail, wheel loads, curvature, etc.

A Number of Tests Were Made

Soon after the plant was put in operation a series of tests was made to determine, first, the relative suitability for treatment of the various kinds of timber available, and second, the proper grouping of different kinds for treatment to insure the best possible uniformity of penetration and absorption. These tests were made by treating runs of various kinds of timber, both separately and combined, the treatment being carefully supervised to insure uniformity of method and each individual tie being weighed before and after treatment.

A study of the results of these tests, supplemented by the careful examination of samples and borings made from treated ties of the various test runs, verified the original conclusion that the full cell treatment of ten pounds of creosote per cubic foot of timber would insure the maximum life of the timber, provided the ties are protected from mechanical wear by properly designed tie plates, and at the same time would be entirely practicable with the choice of woods available. A study of the tests also indicated the proper grouping of varieties of woods during treatment to allow of treating in the same run, ties of relatively equal permeability.

The grouping finally adopted is as follows:

1. Long leaf yellow pine (heart grade).
2. Sap yellow pine.
3. Beech and hickory.
4. Hard maple, soft maple, cherry.
5. Red oak, black oak, pin oak and others of the red oak family.

Only ties of the same group are treated in one run.

Due to the fact that some woods are much more refractory than others, it was found necessary to modify to some extent the decision to treat all ties with ten pounds per cubic foot and the practice finally adopted is as follows:

Beech and hickory are treated with ten pounds per cubic foot or, failing this, the treatment as carried to refusal.

Sap yellow pine is treated with ten pounds per cubic foot.

Maple is treated with ten pounds per cubic foot, or failing this, the treatment is stopped after 12 hours.

Red oak and other oaks of the red oak family are treated with ten pounds per cubic foot or, failing this, the treatment is stopped after 12 hours.

Yellow pine bridge timber is treated with ten pounds per cubic foot; the time of treatment being determined by the condition of the timber, proportion of heart wood, etc.

Air Seasoning Studied Carefully

Studies of the rate of air seasoning of ties were made by weighing groups of ties of the same species of wood when received green at the plant and at frequent intervals thereafter until the loss of weight indicated that the ties had fully seasoned. The ties on which the seasoning tests were made were kept piled in standard piles, the same as all other ties received at the plant, and piled for seasoning and in the same location so that the tests were conducted under the practical working conditions of the plant. To determine what effect, if any, preliminary steaming would have upon air seasoning of ties, comparative tests were made of sap pine, beech and maple ties. In each of these tests one group of ties was air seasoned and another group containing the same number of ties was first steamed and then air seasoned, successive weighings being made as in the other seasoning tests. In selecting ties for conducting all of the seasoning tests an endeavor was made to pick out samples representative of the general run of the ties being received in actual practice, including those with a large proportion of heart wood, those with a small proportion of heart and those with the average proportion of heart to sap wood.

Arrive at Several Conclusions

The conclusions drawn from these tests follow:

In general, practically complete air seasoning under conditions existing at the plant is completed in a period of about six or seven of the spring, summer and early fall months, the ties losing from about 14 to 29 per cent of their original weight during that time.

If late fall or winter months intervene during the process of seasoning the result is seriously retarded. Seasoning not only stops during these months but the ties actually gain moisture, resulting in additional time being required in good seasoning weather to complete the seasoning. For instance, the tests indicate that in good seasoning weather red oak ties lost approximately 18 per cent of their original weight in a period of seven months, but when late fall or winter months intervened they lost only 16.9 per cent of their original weight in a period of 14 months.

While most kinds of wood complete their seasoning in about seven months of good weather, there is generally some further loss of weight for a period of several months longer but as the rate of this additional seasoning is so slow, it is not practicable to attempt to take advantage of it. Furthermore, it is probable that decay of ties takes place much more rapidly during the last half of the period of air seasoning than at

any other time on account of the longer exposure.

The records of three tests of ties first steamed and then air seasoned are somewhat inconclusive and indicate such a wide variation of performance of different varieties of ties that further studies would seem to be advisable. In the case of 12 sap pine ties the effect of the steaming was to expedite the seasoning during the first 2½ months, after which for the next 2 months there was comparatively little difference in the rate of seasoning of the ties which had first been steamed. After the fifth month the steamed ties continued to season at practically the same rate as those which had not been steamed but the degree of seasoning was uniformly less in the steamed ties. A similar condition is shown in the report of ten beech ties. A conclusion to be drawn from these tests apparently is that the effect of the steaming is to open up the cells of the wood, allowing a comparatively rapid seasoning until the loss of natural moisture is sufficient to make the tie more than normally receptive to the atmospheric moisture, which then acts to retard the seasoning.

In the case of maple ties the effect of the preliminary steaming was entirely different. There was a slightly increased rate of seasoning of the steamed ties for the first month, after which the seasoning rate for both kinds of ties was practically the same but the steamed ties seasoned more completely during the entire test. In our opinion preliminary steaming of ties is a doubtful expedient, liable to do more harm than good and should not be resorted to except where the time available will not admit of the natural process of air seasoning.

Records to Date Indicate 25 Year Life

The practical success of the use of treated ties is amply demonstrated. The ultimate justification for the use of treated ties is the longer service life of such ties over untreated ties. For a number of years prior to the use of treated ties the average renewals had been in the neighborhood of 200 ties per mile of main track each year. Soon after the use of treated ties was begun the renewals per mile began to decline each year until at present an average of only 95 ties are renewed per mile of main track each year. All of the lines carry heavy traffic and are maintained in first-class condition as to ties. In particular, on the line between Indiana Junction and Butler Junction the proportion of curves to tangent is unusually large and the curvature and traffic are heavy. There has been no change in the policy governing tie renewals during the period in question except that the progress of replacing cinder ballast with stone in important heavy traffic territory has resulted in a heavier program of tie renewals in these locations than would have resulted if less track each year had been raised out of face and reballasted.

The practical results obtained from the use of treated ties is very strikingly shown in the percentage of ties removed to those put in, and the small percentage of treated ties which have been removed from track for all causes after a service of 14 years.

The service record of all ties points to an ultimate average life of more than 25 years for all treated ties used in main track and this is, of course, far in excess of the average life of untreated ties. The fact that comparatively few treated ties have been removed so far for other than accidental causes makes it evident that no mathematically exact estimate of the life expectancy can be made at the present stage of our experience. The general conclusions as to expected life have, however, been checkd up and are supported by a very careful field examination of many thousand ties now in track.

Results Amply Justify Treatment

The method of treatment and use of treated ties which has been followed is justified by the results attained. The object of treating ties is to prevent decay and to permit the use of woods well adapted for ties if decay can be prevented but which, without treatment, are entirely unfit for use. There are in track many treated ties which show more or less evidence of decay and which may eventually be removed for that cause, but close inspection of a large number of such ties selected for special observation shows little or no change in their condition from year to year, pointing to the conclusion that such ties will give good service in track indefinitely and may ultimately be removed for some cause other than decay. In most of the cases referred to the cause has been traced to incipient decay started in the tie before treatment or to ties having been treated before they were fully seasoned. A large proportion of the ties now in track which show any evidence of decay are those treated during the first two years of operation of the plant when, as above noted, conditions as to supply and seasoning of ties were not as fully under control and the methods of inspection not so well organized and careful as subsequently.

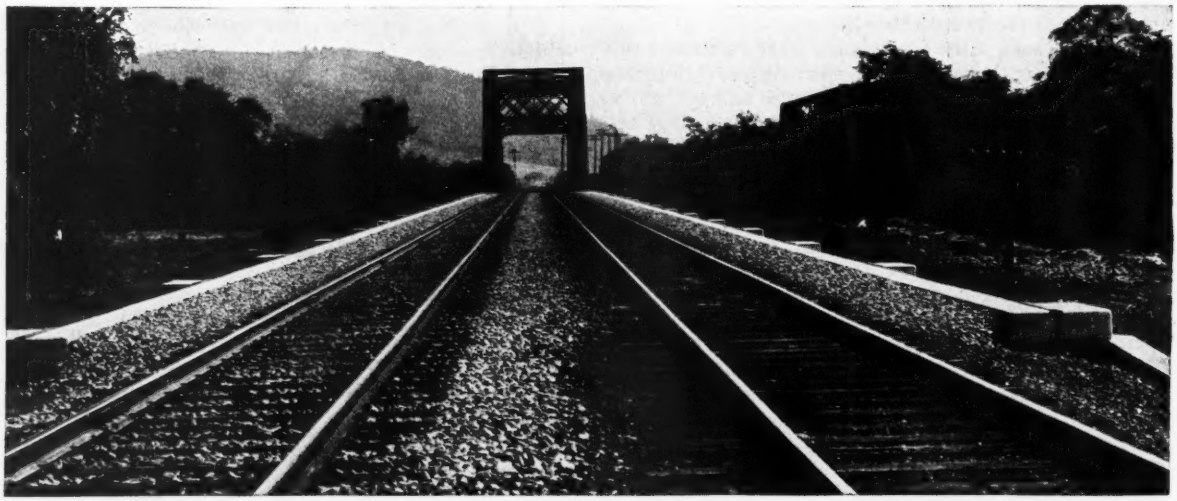
Develop Interesting Conclusion on Tie Plates

Along with proper methods of treating ties must go proper methods of using them, as explained earlier in this article. The life of any treated tie would be comparatively short if used in track without tie plates, and in consideration of the expense of treating ties and

THE NUMBER AND KIND OF CREOSOTE TREATED TIES PLACED IN AND REMOVED FROM MAIN TRACK

		TIES REMOVED AND CAUSE OF REMOVAL FROM MAIN TRACK					
Kind of Ties—	Creosoted Ties Placed in Main Tracks	Decay (1)	Wrecks, Derailments (2)	Broken, Split, Checked (3)	Mechanical Wear (4)	Replacements, Turnouts, etc. (5)	Total Creosoted Ties Removed
Tamarack	971		1				1
Elm	9,669	3	47	28	5	1	84
Red Oak	95,763	6	689	213	70	35	1,013
Black Oak	40,461	3	278	113	18	19	431
Pin Oak	10,740	1	10	25	2	5	43
Maple	219,528	18	3,715	541	63	273	4,610
Beech	240,634	22	2,490	761	112	73	3,458
Birch	9,086		91	35		4	130
Cherry	4,188		20	17	18	3	58
Gum	11,196		29	19	10	1	59
Chestnut	61,727	43	1,201	1,967	4,456	62	7,729
Hickory	29,583	8	60	71	8	2	149
Pine	523,460	15	3,618	526	99	257	4,515
Ash	574			1	1		2
Unclassified	1,219		430				430
White Oak	201						
Total	1,259,000	119	12,679	4,317	4,862	735	22,712
Percentage	100.000%	0.009%	1.007%	0.343%	0.386%	0.059%	1.804%

putting them in track the use of the best obtainable kind of tie plate is fully justified. The thickness and size of the tie plates have been increased from year to year as traffic and wheel loads have increased. The Goldie shoulder claw tie plate has been used exclusively on our treated ties and is in fact the only kind of tie plate now used on any ties and the results obtained have fully justified our adherence to this type of plate. Contrary to frequent suggested objections to the Goldie tie plate, our experience has proved that they cause absolutely no damage to treated ties, nor do they hasten deterioration. One of the principal requisites of tie plates is to have proper adherence of the plate to the tie and this is best secured in the Goldie plate. The claws of these plates not only assure maintenance of proper gage and prevent the plate chafing the tie, as they absolutely adhere to it, but they also, in compressing the fibres of the wood, cause a concentration of the preservative immediately around the claws, thus affording additional protection against decay where it is most needed. The claws also



Increasing the Life of Ties Is an Influence in the Direction of More Permanent Track

completely seal the holes which they make in the tie and thus prevent moisture from getting below the surface of the wood.

These conclusions have been reached after very careful investigation covering the entire period of our treatment of ties and are based on the inspection of ties in track and those taken out of track for various causes. Any indication of decay of treated ties around the holes made by the tie plate claws is so rare as to be entirely negligible. To further verify these conclusions samples of treated and untreated ties have been removed from track from time to time before they had reached their full life and sections made through the claw holes. These sections show some cutting but more compression of the wood fibre and there is no decay in or around the claw holes even in the untreated ties.

Native Hardwoods Most Satisfactory

The most satisfactory woods to treat for ties are the native hardwoods local to our lines such as beech, maple, red oak and hickory. These woods take treatment sufficiently well to insure preservation against decay and show a comparatively small proportion of failure from checking combined with a high resistance to mechanical wear. Considering only those ties of which there are more than 10,000 now in track, those which have so far had the least number of renewals on account of decay only are: gum, pine, red oak, black oak, maple, beech, pin oak, hickory and chestnut in the order named, the ties removed in comparison to those placed in track being in the proportion of 7 per 100,000 in the case of gum and 70 per 100,000 in the in interpreting this feature.

How the Woods Compare

Making a similar comparison of ties of which there are more than 10,000 now in track and considering all except accidental causes of removal, the proportion of renewals to those in track is found to be in the followirg order: pine, gum, pin oak, maple, hickory, red oak, black oak, beech and chestnut, the ties removed in comparison to those placed in track being in the proportion of 122 per 100,000 in the case of pine and 10,476 per 100,000 in the case of chestnut, these being the extremes.

Considering removal due to accidental causes (wrecks and derailments) the large percentages of ties removed for that cause are among the pine, chestnut, beech and maple. It should be borne in mind that the accidental causes of tie failure are purely a matter of chance and this should be given full consideration in interpreting this feature.

The treated pine tie, while satisfactory so far as resistance to decay and standing up well against mechanical wear on tangents and light curves is concerned, is not suitable for heavy curvature and has a low resistance to damage or destruction by derailments. These ties must be secured from the South with consequent increase in initial cost of the tie due to freight rates. For these reasons, therefore, they are not generally satisfactory as compared with the native hardwoods.

Chestnut Ties Not Suitable for Main Track

The same objections except source of supply apply with even greater force to the treated chestnut ties. These ties are entirely unsuitable for main track use, even under comparatively light service conditions. The treatment of chestnut ties was discontinued some years ago for these reasons and we continue to use them untreated only in comparatively unimportant side tracks where service requirements are light. About 80 per cent of the treated chestnut ties removed from track on account of mechanical wear are found to be fit, by turning them over, for re-use in side tracks

where the traffic is not particularly heavy and in such locations they will last indefinitely.

At the time the timber preserving plant was put into operation we were constructing a ten-mile, double-track main line revision and one of the curves on this piece of work was selected as a test track on which to observe the relative service to be obtained from untreated white oak, in comparison with creosoted hardwood ties.

The curve is a three degree curve approximately 4000 feet long, the grade being 0.3 per cent against the light traffic. Both tracks were laid with 90 lb. A. S. C. E. section rail, full plated with Goldie tie plates and ballasted with cinders. Both tracks are subjected to comparatively heavy main line freight traffic and high speed passenger traffic. The curve was divided into four equal parts and one-half of each track was laid with untreated white oak ties and the other half with creosoted hardwood ties, the position of the treated ties in each track being reversed; that is, the north half of the southbound track and the south half of the northbound track were laid with the treated ties. This arrangement was convenient for ready comparison of the service of the treated and untreated ties, both in the northbound or heavy traffic and in the southbound or light traffic track.

The data so far observed on this piece of test track are as follows:

Total number of untreated white oak ties placed in northbound track	1,091
Total number removed up to January 1, 1925	285
Percentage removed (Cause of removal—decay)	26.1
Total number treated hardwood ties originally placed in northbound track	1,091
Total number removed up to January 1, 1925	62
Percentage removed (Cause of removal: 59 ties damaged by derailment, 1 tie broken and 2 removed for test purposes)	5.7
Total number of untreated white oak ties originally placed in southbound track	1,091
Total number removed up to January 1, 1925	321
Percentage removed (Cause of removal—decay)	29.5
Total number of treated ties originally placed in southbound track	1,091
Total number removed up to January 1, 1925	2

Since the track was laid originally in 1910, the northbound track has been relaid with 100 lb. A. S. C. E. section rail, full tie plated with Goldie tie plates, which work was done in 1921. No regaging or rolling of the rail has been necessary either before or after relaying rail on northbound track. On the southbound track the original rail is still in use and no gaging or rolling of the rail has been necessary where the track is laid with treated ties, but gaging and rolling the rail in has been done once on the portion laid with untreated oak ties. No attempt has ever been made to give this curve particularly careful attention as to maintenance conditions and the results represent strictly average conditions on our line.

In 1913 a second main track was constructed and put into operation between Rochester and Scottsville, N. Y., a distance of about 12 miles, and the new track was laid principally with treated ties of various kinds of wood. This piece of track has, therefore, afforded an opportunity for close observation of the service of treated ties during a period of about 11 years under actual traffic conditions.

After a period of about 11 years service, ending January 1, 1925, a total of about 11 per cent of these ties had been removed for all causes, the principal cause of removal being mechanical wear, confined almost entirely to the chestnut ties. Less than 0.02 per cent of the ties have been removed on account of decay.

The main tracks of the Buffalo, Rochester and Pittsburgh are laid with 90 lb. and 100 lb. A. S. C. E. section rail in the following proportions:

100 lb..... 75 per cent
90 lb..... 25 per cent

Fifty-two per cent of the ballast in main tracks is crushed stone or slag and 48 per cent is cinders. The maximum traffic density for the years 1908 to 1924 inclusive occurred in 1918 when 6,629,000,000 gross tons were moved one mile.

The alinement of main track is 35 per cent curve and 65 per cent tangent, on some divisions the proportion of curvature is as high as 47 per cent with curves ranging as high as 10 deg., several 8 deg. curves and numerous 7 deg. curves. Heavy power is used on practically all parts of the line as indicated by the wheel loading of the following types of engines:

Pacific. Weight of Engine (Without Tender)..267,000 lbs.
Mikado. Weight of Engine (Without Tender)..280,000 lbs.
Mallet. Weight of Engine (Without Tender)..445,000 lbs.
Mallet. Weight of Engine (Without Tender)....569,000 lbs.

As ours is largely a coal carrying railroad, the greater part of the freight tonnage is handled in 50-ton and 70-ton steel hopper cars.

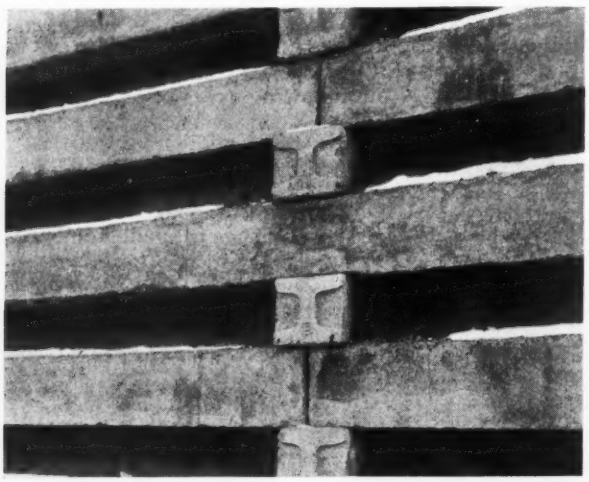
Illinois Central Builds Long Wall of Concrete Cribbing

AN EFFECTIVE design of concrete cribbing has been used by the Illinois Central for retaining wall construction in connection with grade separation and improvement work now in progress in Chicago. The wall extends along the west side of the railway's embankment from Sixty-seventh street to Seventieth street for a distance of nearly 2,000 feet. The height varies from 6 feet to about 10 feet. It retains the sand filling of the embankment which is surcharged at the natural slope of the material to the full height of the embankment. The construction of the wall is such that the height may be increased readily whenever it is desired to increase the top width of the embankment. This wall is a permanent installation although the same construction may be used for temporary work as it may be readily dismantled and erected elsewhere.

The Fill Was Placed as the Wall Was Built

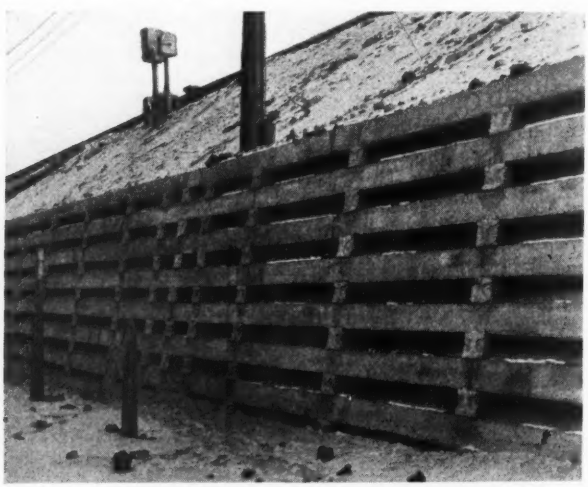
The wall was constructed of pre-cast units furnished by the R. C. Products Company, Cleveland, Ohio, these units being designed to form an inter-

locking cellular crib construction. The stretchers, or longitudinal members, which are the same for both the front and rear of the wall, are of a double channel or I-shape, 12 feet long. They are 8 inches wide on the two plain sides and 7 inches wide across the channels and are placed in the wall with the channels up and down. The headers or transverse members have the same general cross section as the stretchers, but are placed with the stems of the I-section vertical and are equipped with lugs on the top and bottom faces at each end, designed to fit into the top and bottom chan-



A Close-up View of the Wall Face

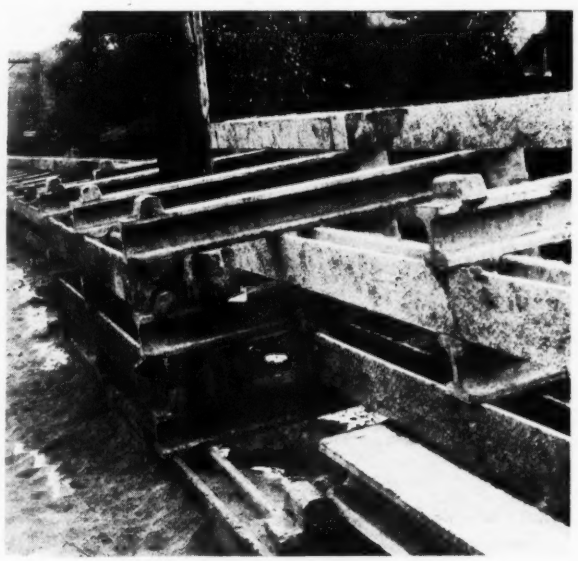
nels of the stretchers. As seen in the photographs, these lugs have an outline closely approximating that of the recesses or channels in the stretchers but with ample clearance to permit adjustment incident to settlement or distortion of the wall. It will be seen also that the interlocking is of a positive character which insures the holding of each piece in its place without the aid of earth pressure and regardless of the slope of



The Wall Supports a Surcharged Fill

the wall. Furthermore, the joints between the headers and stretchers can be made at any point in the length of the latter, although it is usual practice to place the headers in rows six feet center to center, breaking the joints in the stretchers alternately opposite each row of headers as shown in the upper view.

The lengths of the headers are varied to provide whatever width of wall is required for a given height, the headers being furnished in lengths of four, six and eight feet, using longer headers in the lower courses and four-foot headers in the upper portion of the wall. In addition, a footing is provided under the toe of the wall for the purpose of carrying the foundation below the frost line, using two lines of stretchers as in the wall above the ground line but with four-foot headers. At the ground level the rear stretchers are set back to interlock with six-foot or eight-foot headers. However, for ordinary heights of wall it is not necessary to use headers longer than six feet, using two tiers of these headers for walls six feet high, three tiers for walls eight feet high, four tiers for walls ten feet high, and six tiers for twelve-foot walls. This arrangement, however, may be varied to meet special conditions, as in the case of the Illinois Central wall where a row of telephone poles located just behind the rear of the wall made it necessary to introduce eight-foot headers in order to carry the wall around them. The manner



How the Wall Was Carried Around Telephone Poles

is preferable to carry on the wall construction and filling simultaneously in order that the filling material in which this was done is shown in one of the photographs.

As stated above, it is possible to build a wall complete before any of the filling is placed. However, it may be tamped around the lower members and the work on the wall can readily be suspended and again resumed to meet the requirements of the filling program. Work on the Illinois Central wall was carried on intermittently in this way, the units being erected as fast as they were received in cars to insure the prompt release of the cars and avoid the extra handling of the units in storing. The units were erected by the Ellington Miller Company, Chicago.

ASSOCIATION HAS MANY MEMBERS.—The Mutual Beneficial Association of Pennsylvania Railroad Employes, Incorporated, now has a membership numbering 17,000 employes in 68 local assemblies. Over $7,000,000 worth of insurance has been written for the employe-members and the investments held by the association total over $650,000. Since organization in 1914, over $275,000 in death and permanent disability benefits has been paid to beneficiaries.

How to Get The Best Results From Maintenance Labor*

A Summary of the Essential Requirements for an Efficient, Permanent Force of Men

By C. C. COOK

Assistant Engineer Maintenance of Way, Baltimore & Ohio, Baltimore, Md.

APPROXIMATELY 21 per cent of all railroad employees, numbering in excess of 400,000 men in the United States, are variously engaged in the maintenance of roadway, tracks, bridges, signals, shops and other structures constituting the fixed property of the roads. Their work is done in widely scattered areas, frequently without immediate supervision and generally without that close supervision that is possible in manufacturing plants, shops and other industries where all operations are under a single roof or in prescribed area.

The Main Elements

What are the elements of the problem? There is the work to be done and the organization provided for its accomplishment; this includes both the men who actually labor in carrying out the programs of work and the men who design, plan and chart the orderly procedure of the operations. To attain economy complete harmony of understanding of the duties, rights and obligations of all these men is essential.

For the men who actually accomplish the work the items of most compelling interest always will be the wages and working conditions. Any plan for improvement in economy that ignores these two items is headed for destruction; any that considers them only is equally bound for obliteration; the immutable law of balance between supply and demand will ultimately wreck the most carefully laid plan for unfair advantage for any group.

As a result of economic developments of the past decade, these railroad employees are, all things considered, on a par with the employees of like crafts in other industries. Their wages and working conditions are stabilized and fluctuate only as the rise and fall in the cost of the products of the nation make more or less permanent and pronounced change.

Our study of improved economies presumed a satisfactory adjustment of those items and thereafter passed at once to a consideration of those other features which appeared most important. In the order of their investigation they were: (1) The methods for obtaining satisfactory employees; (2) the means for retaining in service satisfactory employees; (3) the training and education of employees, (a) those in the engineering department in maintenance work for ultimate control of the planning, designing and control of operations, (b) those, other than engineers, for greater economy and efficiency as well as their own promotion; (4) the establishment of means for stabilizing maintenance of way work so that as far as possible work for all the year round will be provided; (5) the methods of programming maintenance of way work in the interest of efficiency and economy; (6) the provision of sanitary and agreeable living conditions for employees who are enforced by the character and location of their work to occupy improvised quarters; (7) the establishment of standards and units of measure for all work performed which is susceptible of measurement; (8) the adoption of labor-saving devices.

Many of the features pertaining to this outline of investigation will be recognized as being in universal association with all industry and, as in numerous instances, they were more readily applied in outside industries an investigation of the practices and results in companies or works which were outstanding in the benefits they had secured was undertaken. I will not attempt to review the advances made by some of these industries in the development of their special plans for they are of such wonderful variety and unique results as to constitute almost a revolution of the industry wherein they were made operative. An instance of the high point in their development that has been attained is evidenced by the plans of the manufacturers of one well known national product who have established "guaranteed employment" of 48 weeks per year to every employee after six months service and have in addition thereto established an employees' stock participation plan with employee representation on the board of direction that has resulted in a wonderful esprit de corps and marked co-operation for productivity.

The place that these items have in the railroad industry is stated in the following conclusions adopted by the committee and the association to which I have referred:

"(1) In order to retain satisfactory employees, railway managements should provide means for the fullest possible co-operation between employer and employee, arranging for the education of all employees and particularly those in a supervisory capacity in the aims of the companies to secure that result.

"(2) Where roads are of sufficient size to warrant the creation of a personnel department, we recommend that such a department be established whose duties shall be the encouragement of employees and their handling without prejudice, in their (a) employment, promotion and transfer; (b) education, training and service, including separation from service. On smaller roads work of the character above outlined should be assigned to some officer in the existing organization, to be handled independently of his relation to any particular department.

"(3) The adoption of a plan of employee representation in railway work will, through the improvement of the spirit of co-operation, serve largely to stabilize labor and reduce the problem of obtaining new employees.

"(4) The extension of benefit associations providing insurance against the hazards of sickness, accident, superannuation and death is essential to the de-

* A review of the work of the Committee on Economics of Railway Labor of the American Railway Engineering Association, presented before the St. Louis Railway Club on December 18. Mr. Cook is chairman of the committee.

velopment of a loyal and co-operative spirit in railway organizations, which is needed to assist in the work of stabilizing labor and render it more efficient and economical. Savings funds and loan provisions placed at the disposal of all worthy employees are an added incentive of merit and of economic value.

"(5) The promotion of the mutual interests of employers and employees through participation in the ownership of the industry on which they are dependent for their income in wages or dividends is an objective greatly to be desired and warrants the careful consideration of the railways as a means of stimulating co-operation in the common objective.

"(6) Plans for the establishment of satisfactory working conditions, including the provision of sanitary and agreeable facilities while on duty, comfortable rest-houses, rest-rooms and dining rooms, maintained in cleanly condition, and service of a sufficient quantity of wholesome food, should be in effect on all roads.

"(7) The establishment of standards and units of measure for all work performed which is susceptible of measurement, is a fundamental basis of harmonious understanding between employer and employee and the foundation for economical and efficient handling of labor."

Stabilization of Employment

The proposal to stabilize maintenance of way labor so that employment throughout the year will be assured is one that promises most immediate and beneficial results. Every man, despite his station in life, is striving for that contentment which comes from security in his business affairs. When, as in the case of workmen, it is entirely dependent upon their physical effort none can fail to understand its appeal to them. From the standpoint of management it beckons equally as strong. The industrial activities of the country and the railroads as well, have been shot through with the extravagance resulting from labor turnover with all of its evils of disrupted work, inexperienced men, disloyalty and inefficiency.

Great strides have been made in the improvement of the situation. Larger opportunities are lying just ahead. Fortunately in railroad maintenance of way work there is but minor economic reason for fluctuation of force. Only one-third of all maintenance of way expenses are affected by the variation in use made of the property. Two-thirds of the expense would be needed for maintenance, irrespective of traffic fluctuation. The necessity for any considerable variation in force should arise only from the climatic conditions. Neither in the extraordinary demands of the work nor in the need of economic performance is there a call for other than a uniform force of trained employees the year round.

Recognition of this condition is reflected in an order of the Interstate Commerce Commission which permits the carriers of the United States to make uniform monthly charges during each of the 12 months of the year, irrespective of the varying amounts actually spent per month. It only is required that the total for the year be equivalent to the total budget figures prepared in advance or as revised through necessity during the course of the year. There is ample latitude in this provision to enable any railroad to dispose of its maintenance force throughout the year as it deems best without the necessity of variation to meet monthly fluctuations in traffic which of themselves but slightly change the physical maintenance requirements.

The more practical consideration of determining the kind and quantity of work now done during the summer which could be done with equal or greater economy during the winter is one to which our committee is addressing itself. It is commended to all the roads for thorough analysis and revision of practice for the purpose of giving greatest possible stability to force and securing the fruit of that effort—the maximum of economy in results.

A remarkable change with this effect has been made by railroads in recent years. In the item of rail laying, there has developed a transposition for the season of its accomplishment. Formerly the common practice was to wait the spring or summer period, at which time all other major items of track work were being put under way. As a result force restrictions, traffic density and material shortages caused excessive waste of effort and inefficiency. With the adoption of the policy of laying rail during the winter, which is possible generally in this temperate zone, the regular force is combined to complete this productive work during the winter months when they otherwise would either not be employed or else be used on work which is unproductive and probably not essential. The net result is that almost the entire cost of doing work of that character can be considered a saving.

There are many items of maintenance work that can be thus transposed, such as widening embankments, tightening bolts, tie plating out of face, distributing cross ties and switch ties, inside work on structures, curing soft spots in roadbed, fencing, etc., the total of which will greatly provide for the uniform distribution of force so much to be desired.

Programming Maintenance of Way Work

As a corollary of the preparation of a budget and the distribution of expense which will provide for as nearly a uniform force as possible during the entire year, there are needed carefully outlined and definite programs of work. These should be based on the system requirements but also should be prepared and carried out on the divisions. The committee's recommendations in this respect were:

"The orderly prosecution of maintenance of way work throughout the year is essential to its most economical conduct. It is promoted by:

"(a) The preparation of a budget of the work to be done during the year and the authorization of this budget for the year, if possible, or quarterly at least, sufficiently in advance of the inauguration of the work to enable materials and men to be collected in an orderly manner.

"(b) The equalization of expenditures on roads where it is practical in accordance with the plan authorized by the Interstate Commerce Commission to eliminate the wide fluctuations in expenditures from month to month.

"(c) The preparation of a detailed program in which the work authorized is scheduled so that it may be done at the most economical season consistent with the most efficient utilization of forces.

"(d) The carrying of this program down to the local divisions and to the individual gangs on those divisions in order to enable the work of these men to be directed to the best advantage."

The need for maintenance work in both isolated and congested territory where living facilities are not readily available makes necessary the provision of housing facilities for the temporary accommodation of employees assigned to those regions. The time has passed when large numbers of men can be grouped in cramped quarters without the conveniences needed for healthful living. Not only the conveniences that make

for sanitation of camps are now provided, but many features of entertainment which are part of this modern period are installed. They exert a profound influence in increasing the morale of these workmen—an item of intangible but yet incalculable value in securing efficiency of effort.

Standard Methods and Units of Measure

The widely ranging area of maintenance of way work is matched only by the diversity of items that constitute its program. Railroad managements have been compared to their disadvantage with other industries whose methods were standardized and whose individual operations were measured on a unit basis.

Our committee early made extensive investigation of standard methods for performing maintenance of way work for the purpose of establishing units of measure of performance and is continuing its study along that line to determine as far as possible units of measure of performance of maintenance operations.

Comparisons of performances are as valuable to foremen as they are to managers in securing economical results. The foreman who so arranges his gang when possible as to have each man or each pair of men assigned to a half rail length of track, directing them as to the best method of doing the work and inspiring them to equal or to exceed a standard of performance, will invariably secure greater efficiency. The management which has developed and made effective the best methods of doing the various items of work and uses all the data on unit performances it is possible to develop for comparing results from gangs, sub-divisions or divisions, will in proportion secure the greatest economy in results.

A well defined plan of making such an application of methods to track work was presented by our committee, received the approval of the association and is a part of the record in its manual. It is to be commended to the roads for their serious consideration and application in the effort to develop full economy in track labor.

Labor Saving Devices

The last item to be discussed, but not the least in this day of restriction of immigration and other inroads upon the unskilled labor market, is the use of labor saving devices. It may be thought that labor itself is not in sympathy with the substitution of such devices for the products of their hands. A little reflection of our situation will show the fallacy of that opinion. In the first place those devices large and small are aids rather than substitutes, and are welcomed as such. Men who are asked to maintain satisfactorily a given mileage of track clamor for those devices which relieve them of such laborious work as excavation in ditches, cleaning of stone ballast and handling rail weighing from 100 to 150 lb. per yard, all of which can be done many times as rapidly and with but a small percentage of manual effort by the use of ditching machines, locomotive cranes and rail laying machines. The smaller tools of recent marketing such as the portable rail saw, the track liner and ballast screen which enable one man to accomplish with less effort more than two to five men can accomplish with hammer and rail cutter, lining bars and forks are equally desired. Their use enables the force to spend just that much additional effort in the renewal of materials that cannot be thus handled and in the maintenance of the degree of excellence in track line and surface demanded by present day traffic. Every encouragement is to be given to those who have the vision and the initiative to conceive, design and market any device that promises economy in maintenance.

Summary

The outline I have attempted to give is inadequate to even suggest the magnitude of the subject. There has been no desire to criticize the record of the past or to assign unfair responsibility for the improvement of the future which is inevitable. Men and management have an equal responsibility to continue the development of harmony in their relations and in the direction and performance of work essential to the true economy of railway labor.

There need be no visions of a millenium of harmonious effort and 100 per cent efficiency, but if those in authority will continue their practical analysis, and the application of the data and knowledge thus made available, and the men will co-operate in the effort which in the fruition will result in advantage to them as well as to economy for the roads, there will be at least a continuation of the progress that has made the unhampered railroads of America the most efficient transportation system the world has yet produced.

Compressed Air Plant on Cars Used to Test Wells

By Charles L. Eldred
Assistant Engineer, Atchison, Topeka & Santa Fe,
Los Angeles, Cal.

A LARGE NUMBER of the wells drilled by the Santa Fe in New Mexico, Arizona and the eastern part of California or on the Great Desert, range from approximately 1,000 ft. to 2,500 ft. in depth and the water plane is at such a level that deep well pumps or air lift pumps are necessary. It is common knowledge among engineers interested in obtaining water from wells that the data often obtained to determine the yield and draw-down are more or less of a guess, if not done with properly designed equipment. Methods are often resorted to, to save what the uninitiated would consider unnecessary expense, that are unsatisfactory in that the results obtained do not denote the actual yield of the wells, resulting in the selection of sizes of pumping equipment that are unsuitable for the conditions. Where it is desirable to obtain all the water that can be produced nothing should be overlooked to get the desired results.

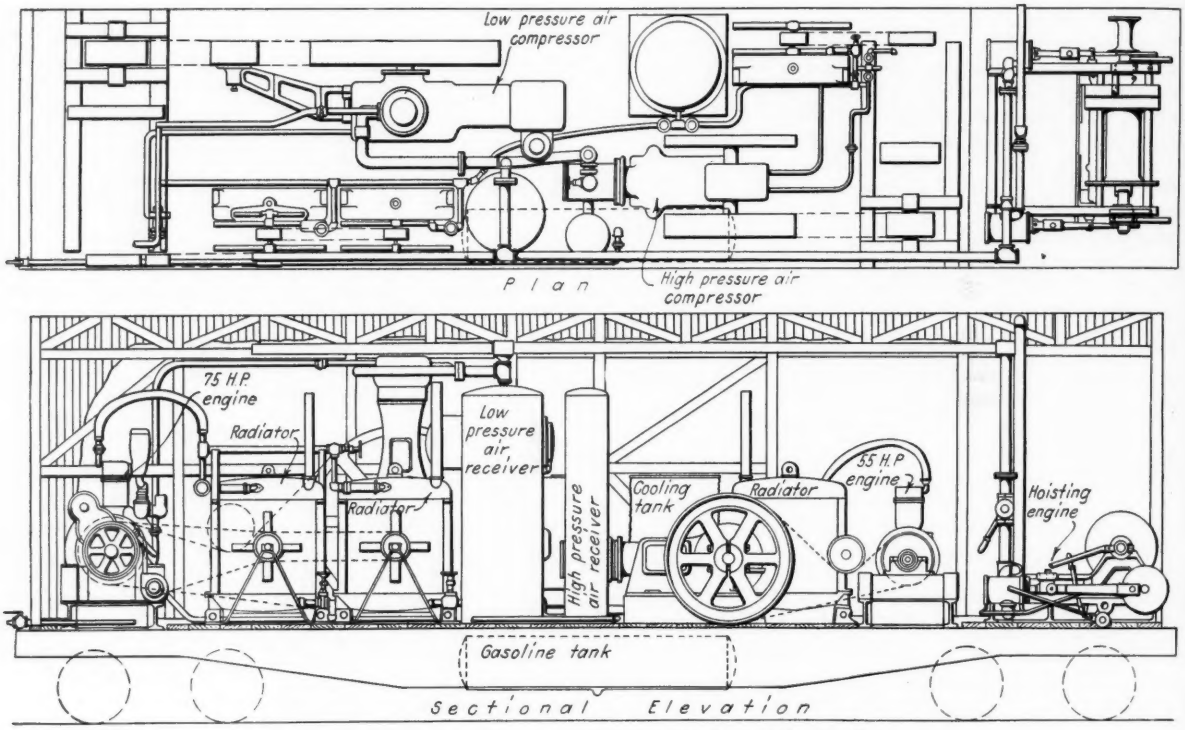
With this knowledge, or the lack of it, the necessity of a portable well testing outfit that can be used over a wide range of conditions is apparent. As many of the wells in this territory are of the air lift type, it was thought that the most satisfactory equipment for this purpose would be a compressed air plant.

Before finally selecting the machinery, careful studies were made of capacities, pressures and adaptability, resulting in the selection of two air compressors driven by gasoline engines. One unit consists of a Sullivan Machinery Company's 14-in. by 8¾-in. by 10-in. Class W. J-3 angle-compound compressor built for a working pressure of 120 lb. per sq. in., driven with a short belt drive by a Holt Manufacturing Company's 75-hp. gasoline engine built on a special fabricated steel base.

A second unit consists of a Sullivan 5⅜-in. by 10-in. Class W. G-61 booster air compressor built for a maximum working pressure of 450 lb. per sq. in., belt driven by a Holt 55-hp. gasoline engine equipped with a friction clutch. Each engine is equipped with a Stewart vacuum feed system and a Pomona air cleaner. Low pressure and high pressure air receiver tanks are con-

nected to the discharge line of the air compressors. The air piping and air receivers are so arranged that the low pressure compressor can be operated independently of the high pressure machine, or both units can be operated in unison, the high pressure machine acting as a third stage compressor or booster. The cooling system consists of a 200-gal. cooling water tank, three radiators and fans such as are used for the 75-hp. engines, and circulating pumps.

After the cooling jackets of engines and compressors are filled and the machinery started the circulating pump on the 75-hp. engine draws the water from two radiators



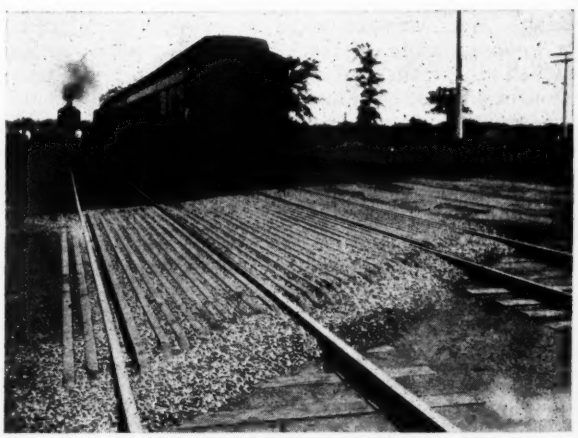
Arrangement of the Pumps and Other Equipment in the Car

(interconnected) and forces it through the large or low pressure compressor, thence through the 75-hp. engine back to the radiator. This arrangement is almost ideal in that the water first passes through the compressor where it absorbs just enough heat so that the temperature is right for the most efficient operation of the engine. For the second unit, part of the water from the third radiator is by-passed through the small or high pressure compressor and the balance through the 55-hp. engine back to the radiator.

This machinery was erected on a 40-ft. flat car so as to occupy about two-thirds of the car. The remaining portion of the car is taken up by a 7-in. by 10-in. double-cylinder, drum hoisting engine operated by compressed air. The purpose of the hoisting engine is to pull pump columns from the wells. The 40-ft. flat car was specially reinforced in the railway company's shops to carry this heavy machinery and to withstand the vibration while in operation. After the machinery had been placed in position and securely anchored, the whole was housed in with construction similar to that provided in a standard box car.

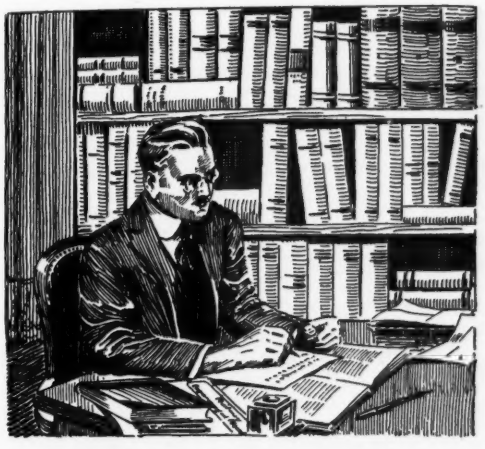
A second car (a 36-ft. flat) carries the gasoline supply, tool box, a weir for measuring the water pumped, a lubricating oil supply and miscellaneous piping for air lift pumping. To comply with the regulations regarding the transportation of gasoline, four Pintsch gas containers, each holding approximately 150 gal., were set up in a cradle, two at the bottom and two at the top, and piped together so that when one tank is filled the gasoline will flow into the other three. One Pintsch gas container was hung under the flooring of the machinery car for engine supply. This is filled from the battery of tanks on the second car by means of a flexible hose when required.

This outfit was designed by George L. Davenport, Jr., assistant engineer in charge of water service, Los Angeles, Cal., and the actual work of installing and arranging the outfit was done under the direction of E. F. Calleher, assistant master mechanic in charge of shops at Richmond, Cal.



D., T. & I. Highway Crossing Made of Old Rails

What's the Answer?



This department is designed to serve as a reader's service bureau, wherein the many problems which arise in the routine maintenance of tracks, bridges, buildings and water service facilities, may be subjected to frank and thorough discussion. The value of the service thus rendered is proportionate to the extent to which readers avail themselves of it, in submitting questions and in lending their co-operation by offering answers to the questions presented.

Questions to Be Answered in the March Issue

1. *What measures are necessary to the maintenance of the proper super-elevation on curves?*

2. *In view of the difficulty of taking water tanks out of service, is it practical to attempt to paint the interior of steel tanks and, if so, at what intervals and under what conditions is this necessary?*

3. *What is the best method of marking ties to be renewed?*

4. *Is it advisable to make a detailed permanent record of the driving of each pile in a structure or merely of typical ones?*

5. *What measures should be taken to insure the accuracy of section foremen's level boards and track gages?*

6. *What is the proper relation between the width of treads and height of risers for stairs?*

7. *What measures can be taken to stimulate interest among foremen in the care of their motor cars?*

8. *What measures may be taken to stop scouring beyond the downstream end of a culvert?*

Should a Tie Be Tamped On One or Both Sides?

Is it good practice to tamp only one side of a tie in rock ballast or should both sides be tamped?

Tamp Both Sides of the Tie

By J. W. Powers
Supervisor of Track, New York Central, Rochester, N. Y.

Unquestionably, ties should be thoroughly tamped on both sides so as to furnish a solid and uniform bearing for the rail. Satisfactory surface can not be maintained in any ballast except by tamping both sides of the tie. Although more expensive in first cost, stone ballast, if properly selected, will give the best results, and will prove the most economical ballast on tracks of heavy traffic. In addition, it is appreciated by the traveling public, owing to the absence of dirt and dust.

Ties Should Be Tamped on Both Sides

By Thor Monrad
Section Foreman, Northern Pacific, Lockwood, Mont.

It is not good or safe practice to tamp a tie only on one side in rock ballasted track, or any other kind of ballast. If the tie is tamped only on one side it will tend to turn over towards the side which was not tamped. It is also my experience that this will increase the tendency of the tie to slew. It will also shorten the life of a tie because it will not have a uniform bearing surface under the rail and will also tend to injure the rails and the tie plates.

It Depends Upon the Amount of the Raise

By D. T. McKee
Section Foreman, Hocking Valley, Logan, Ohio

If track is to be raised two inches or less it is better to tamp both sides of the tie as it is impossible to get good results unless this is done. However, if the track is to be raised more than two inches, only one side of the tie should be tamped because if both sides are tamped the tamping on the second side has a tendency to weaken the tamping done on the first side.

Both Sides with Hand Tamping, One Side with Power Tampers

By I. H. Schram
Regional Engineer, Erie, Chicago

This question has been somewhat complicated since the introduction of the pneumatic tamper. We always insisted on this railroad, in the days of hand tamping, that both sides of the tie be tamped and that it be tamped both inside and outside of the rail, the work to be done with a tamping pick. We have felt that well tamped track could be obtained in no other way. The introduction of the pneumatic tamper has changed the situation, however. One of the greatest difficulties is to avoid overtamped track, which rides as badly or worse than track not sufficiently tamped. Another trouble with pneumatic tamping is the possibility of humping one side of the tie or of shoving the ballast through. We have therefore followed the practice of tamping inside the rail on one side of the tie and outside the rail on the opposite diagonal corner

when using pneumatic tampers. The side receiving traffic is tamped on the outside. We get better tamping this way than by tamping all four corners around the rail with the tamper and also better results than with hand tamping.

Joints are sometimes tamped at all four corners. This is done particularly with old rail that is somewhat bent. We still have 90-lb. rail in service that was laid 12 to 14 years ago when new double track was built. Some of this rail is bent from the quarters to the joint and best results are obtained by tamping the four corners of the ties under the joint.

Should Waiting Room Floors Be Higher Than the Platforms?

Should the floor of a passenger station be flush with the platform or raised one step above the platform?

It Depends Upon the Size of the Station

By Architect

In most cases the waiting room floor is raised one step above the platform level to prevent the water from a driving rain being blown in under the doors. However, in the larger stations where the platform is covered by a wide canopy or where a concourse is provided between the platforms and the station, the platforms, concourse floor and waiting room floor are placed at a common level or such difference in elevation as may exist is overcome entirely by a ramp. This is done to expedite the movement of passengers from the waiting room to the platforms and vice versa, because of the obstruction which this introduces in the expeditious movement of any considerable number of people. The same practice is also being followed by some roads with respect to smaller stations, particularly in arid or semi-arid country. It is also becoming increasingly common to avoid a step between the waiting room and the platform or walk at the street side of the station, where the entrances are covered with a marquis.

The Waiting Room Floor Should Be One Step Higher

By L. P. Kimball
Engineer of Buildings, Baltimore & Ohio, Baltimore, Md.

It is our practice and opinion that the waiting room floor should be one step above the platform to prevent rain being blown in or running in under the door in stormy weather. We do, however, keep the baggage room floor down to practically the platform level, with a small ramp in the doorway for trucking.

Should Track Forces Shim Track on Bridges?

Should a track foreman be permitted to shim track on the end of a bridge to adjust for heaving or should he put out a slow order until a bridge gang can do this work?

Track and Bridge Forces Should Co-operate

By T. J. Irving
Division Engineer, Chicago & North Western, Winona, Minn.

Section foreman should be allowed to shim track on the end of a bridge to adjust for heaving. This is an economical way to make a bad condition safe and does away with putting out a slow order until bridge forces arrive. The bridge foreman should be notified so that he can check up the work done. The bridge forces may be a long distance from the structure which needs attention, and if section forces do the work while at the bridge, considerable expense is saved. Co-operation between the section forces and bridge forces will save the railroad considerable money, eliminate dangerous conditions, and avoid putting out many slow orders.

It Should Not Often Be Necessary

By H. A. Cassil
Chief Engineer, Pere Marquette, Detroit, Mich.

Whether a track foreman should be permitted to shim track on the end of a bridge to adjust for heaving depends entirely upon local conditions, including the ability of the section foreman to do such work properly. New conditions of this kind do not usually develop unexpectedly and the wide awake section foreman knows about what to expect when winter comes. The track supervisor is usually familiar with such locations and from experience and knowledge of the local conditions knows what should be done, that is whether to have the section foreman put in shims, or put out a slow order and send a bridge gang. The real remedy is a permanent improvement in the drainage and ballast so that heaving will not occur. In fact, all track, roadbed and drainage conditions at and near bridges should be given preferred attention.

It Should Be Done by the Section Gang

By Thor Monrad
Section Foreman, Northern Pacific, Lockwood, Mont.

In my opinion it is entirely satisfactory, more economical and just as safe to have the track foreman shim the track on the end of a bridge as it is to wait for a bridge gang to do this work and put out a slow order until the condition is corrected. Track foremen should be instructed to confine this shimming to the bridge ties near the end of the bridge and the shims must be securely fastened. Spread rods should be used in place of wooden or iron braces, as the use of braces will result in the injury of bridge timbers on account of the spiking required. No adzing should be allowed on any of the bridge ties.

Water Service Stock for Emergency Repairs

What stock should be carried by a water service organization on a division of 500 miles to insure prompt emergency repairs?

A Comprehensive Answer

By L. C. Prunty
General Water Service Foreman, Union Pacific, Kansas City, Mo.

The first requirement for a supply of repair parts is a supply room centrally located on the division. It should be in the charge of a district or local repair man or, if at the division water service headquarters, under the direction of a clerk or general foreman. A monthly invoice of the stock should be made to see how much material was used during the last 30 days and what additional material is required for the following month. A check such as this should prevent the accumulation of an excessive stock. Folowing are a few suggestions with respect to the repair parts to be carried for different classes of equipment.

Gasoline Engines. An experienced water service foreman will readily know what parts of a gasoline engine wear out most frequently and repair parts should be provided to correspond. These would ordinarily include two or three complete igniters and several parts of igniters, a few pinion and gear wheels for the valve drive, two or three exhaust and inlet valve stems and valves, governor parts, two or three sets of connecting rod brasses, one complete cylinder and piston, one extra piston and six rings, two complete fuel pumps, two extra fuel pump plungers and necessary clutch parts.

Oil Engines. With one year's experience with oil engines, the

water service supervisor should know about what items to carry on hand. These ordinarily include injection nozzles, one complete injection pump, one complete fuel pump, two fuel pump plungers, three sets of fuel pump packing, six copper gaskets for combustion chambers, one set of main bearing brasses, two sets of connecting rod brasses, one piston pin and bushing, two sets of connecting rod bolts and nuts, a few piston rings if several oil engines are of the same size and type, one complete cylinder, one crank shaft and one connecting rod, one air valve, one starting torch and some clutch parts.

Steam Pumps. If several pumps of the same class and size are used on the division, the parts to be carried in stock are parts that pertain to the valve mechanism on both the engine and water ends of the pump, a few valve stud springs, one or two extra piston rods and valve rods, two complete steam chests and two extra packing glands and gland followers for the steam chest and steam cylinder and water cylinder. No hard and fast rules can be laid down because types of pumps differ and each foreman has to learn his own individual equipment.

Steam Boilers. Steam plants at ordinary water stations should be of the same type and size, if practicable. Three extra boilers should be kept on hand in good repair unless unusually good shop facilities are available for getting them repaired. However, the old steam boiler and steam pump are almost obsolete.

Water Cranes. Duplicate repair parts to be kept at division headquarters for each type of water crane are: six column rubbers or leathers, six valve seats, six piston packings, four bell cranks, three valve bell cranks, two operating lever bell cranks, one set of valve rods, one piston rod, one complete water crane (for immediate erection in case a crane is completely wrecked), one lower column, one upper column, one short extension column, one outlet elbow and three spouts, two complete sets of cable rigging and two sets of cable wheels. There are also a few more minor parts that each individual supervisor will want to keep on hand.

Water Tanks. Where water tanks are equipped with spouts and outlet valves it is necessary to keep an extra goose neck, one valve stand, two valve covers, three valve seat rubbers, four tank spouts, two sets of tank pulleys and chains, three complete sets of valve lever bolts, two extra spout hangers and clevises.

Pipe Lines. For cast iron lines provide two joints of cast iron pipe, two sleeves, two ells, two tees, and one or two valves of each size of pipe. For wrought pipe keep a set of flange unions for each size of pipe and two lengths of each size of pipes. Where several city connections are used keep two repaired water meters on hand if the city does not furnish meters.

Power Pumps. (Used in connection with gasoline or oil engines.) Provide one extra pump complete, also valve springs, valve studs, rubber valves, two piston rods, two stuffing boxes and stuffing box glands, two cross-heads, two piston heads, one set of guide rods, one pair of rod strap ends, two sets of rod strap bolts, one set of rod strip brasses, one crank or wrist pin, two pinions, two gears and one face plate wheel.

In general an emergency stock for maintaining the water supply equipment on a 500 mile main line division should represent an investment of about $3,000. This would not include complete boilers or a complete water crane. In addition to the materials listed above it is necessary to keep on hand a general working stock for repair work and renewals. This includes pipe fittings, unions, valves, bushings, etc., also a complete stock of sheet packing for piston rods. The extent of the stock of this class of materials should depend on the character of equipment in service and must be determined after a careful study by the supervisor of water service. In addition to the stock carried at the division headquarters, the district repair men should be provided with a certain amount of emergency material such as bolts, packing, sheet rubber and pipes and fittings.

It Depends on the Degree of Standardization

By J. K. Pace
Road Mechanic, Water Supply Department, Atlantic Coast Line, Savannah, Ga.

The amount of stock to be carried by a water supply organization on a 500-mile division to be able to make immediate repairs at all times will depend largely upon how far that road has gone in the standardization of pumping equipment. On roads having pumping units of various types, styles and kinds, it will be necessary to carry a much larger stock of repair parts in order to make prompt repairs than on a road where practically all the pumping units are of one or two sizes and the parts are all interchangeable.

On roads where the automatic control electric driven pumping outfits are largely used it has been my experience that enough repair parts are necessary to rebuild one pump and one motor. If two sizes of units are used, enough parts should be kept on hand to rebuild two outfits, that is, to replace all of the vital parts of each pump or motor overhauled.

In addition to the above pump and motor parts, small quantities of pipe, pipe fittings, packing, etc., should be kept on hand at each division point. Where steam-driven outfits are used it is necessary to keep at least two steam boilers with the necessary fittings on hand. These need not necessarily be new outfits but can be overhauled outfits held in reserve. Where oil engines are used I think the same rule should apply as to the stock of parts as for the electric driven outfits.

Stopping Motor Cars While Trains Are Passing

Should a motor car operating on one track of a double track line be stopped before meeting a train moving on the opposite track?

This Practice Will Prevent Accidents

By J. S. Robinson
Division Engineer, Chicago & North Western, Chicago

A motor car should not only be stopped but the men on it should get off and face the train on the opposite track to avoid accidents caused by coal falling off engines, broken brake beams or other parts of equipment on freight trains that are liable to fall down, throwing up the ballast which is liable to strike men on motor cars on the opposite track. In the case of a passenger train, a further hazard is introduced by objects thrown out of windows that may strike men on motor cars on the opposite track.

There Is a Limit to the Number of Specific Rules Which Can Be Applied in Practice

By District Maintenance Officer

While the constant exercise of caution in the operation of motor cars is a matter of utmost necessity it is possible to carry so-called safe practices too far and in my opinion a rule requiring motor cars to stop while a train is passing on an adjacent track represents an undue refinement. It is like requiring motor cars to stop before crossing any highway, no matter how wide the range of vision may be. The important thing in the operation of motor cars is to impress on the operators that they must exercise care in the operation of their motor cars under all conditions. But what constitutes careful operation under one set of conditions may be exceedingly careless operation under another, in exactly the same way that the operation of an automobile at 30 miles an hour on a country highway is under ordinary conditions entirely safe, while to travel at the same speed at a busy street intersection would be extremely hazardous.

As regards the operation of motor cars alongside moving trains on adjacent tracks, our rule provides that the car must be run slowly and that the train be kept under careful observation to detect any unusual conditions while it is passing. This is the rule for operation on tangent track. When operating a motor car on the outside of a curve where the view is obstructed by a train on the adja-

cent track the operator must assure himself of the same degree of protection against meeting a train or any obstruction that he would in traveling around a curve in a cut.

How Should Falsework Changes Be Handled?

When a wooden trestle that is being replaced by a culvert or concrete bridge requires some alterations to clear portions of the new structure, should these changes be made by the concrete gang (company force) or should this be done by a bridge carpenter gang?

Different Jobs Require Different Treatment

By A. B. Scowden
Assistant Engineer Bridges, Baltimore & Ohio, Cincinnati, Ohio

No hard or fast rule can be given, but it is necessary in each case to consider the character and extent of new concrete construction, the amount and type of alterations required to the existing trestle, the equipment and personnel of the gangs available and other pending work that these gangs can be used for.

As a general rule, however, it is considered desirable to have all work on one structure handled by one gang, particularly on smaller jobs. With this in view, the bridge and building foremen are as a rule experienced and capable in handling carpenter work as well as concrete work, and as far as possible, the men under them have been experienced in both. The mason foreman is expected to understand the essential elements pertaining to the safe condition of trestles and is consequently considered capable of making minor changes in the structures under the direction of the master carpenter.

With the above in mind, I would classify the various conditions as follows:

1. On structures where the concrete work is the most important part and the trestle changes of minor importance, all work should be handled by the mason foreman.
2. On structures where the concrete work is comparatively small, but the trestle alterations are complicated or important, all work should be handled by the carpenter foreman.
3. On work involving extensive concrete construction, as well as important trestle changes, a carpenter gang should handle its portion of the work, the mason gang to follow with its work.

Work under Class 1 is frequently assigned to a carpenter gang, if the mason foreman is engaged on more important work, and in such cases, likewise, work under Class 3 may occasionally be assigned entirely to a carpenter foreman, who is particularly experienced and competent in handling concrete work.

Let the Concrete Gang Do It

By F. H. Cramer
Assistant Bridge Engineer, Chicago, Burlington & Quincy, Chicago

When the bents or any other part of a wooden trestle do not clear portions of the new structure, alterations should be made by the concrete gang (company force). The concrete foreman should be a man who has had experience in building and maintaining wooden trestle bridges, and his carpenters also should know the fundamentals of maintenance. This gang will then be capable of handling not only the required alterations in the structure, but any maintenance that may be required during the time that they are on the work, thus avoiding unnecessary slow orders in maintaining traffic.

During the construction of the new structure, especially when deep foundations are required, the trestle may settle and get out of line. Should an emergency arise, where traffic must be maintained at all times, the concrete foreman can handle this situation very well and avoid the large expense of ordering out a bridge carpenter gang to the bridge to carry out work which may take but a short time.

What Shovel Should Be Used?

What type of snow shovel as regards blade and length of handle is preferable for flanging track?

Use Standard Shovels

By J. J. Desmond
Roadmaster, Illinois Central, Chicago

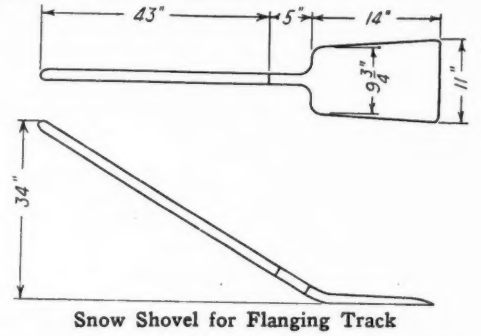
In the removal of snow and ice from frogs and switches, tracks, etc., it is considered advisable to use standard No. 2 track shovels or standard No. 2 scoop shovels when flanging track, for the reason that this type of tool is usually close at hand, and is used for other purposes in connection with the work and thus avoids the use of a special tool particularly designed for handling snow, which might not always be available.

The length of the handle of a No. 2 track shovel is approximately two feet and the blade 12 in. The length of the handle of a No. 2 scoop shovel is two feet and the blade 16 in. It is our experience that the work can be accomplished with these tools as easily as can be done with special snow shovels and that no great advantage results from the purchase of special snow shovels.

Use a Snow Shovel

By A. M. Clough
Supervisor of Track, New York Central, Batavia, N. Y.

The drawing shows the type of snow shovel that we consider the most suitable for all purposes. It is made of pressed steel plate 11 in. wide at the point, tapering to 9¾ in. The blade is 14 in. long, the haft 5 in. and the handle 42 in. with a 34-in. lift.



Snow Shovel for Flanging Track

As flanging is mostly done in yards and around engine houses where a path has been made in the center of track by people walking, it is found that a shovel 14 in. wide is the proper width to flange next to the rail after a heavy fall of snow, without using the pick which must usually be resorted to later.

Bolts in Heel Blocks of Switches

Does the increased facility in changing switch points by having all the bolts entering the heel blocks from the outside justify the sacrifice of safety afforded by staggered bolting?

The Sacrifice of Safety Is Very Small

By A. B. Hillman
Roadmaster, Belt Railway of Chicago, Chicago

The only safety afforded by staggering bolts is that all bolts will not be sheared off in case of a derailment. With a heat treated bolt of the diameter generally in use at the

heel of switches the danger of all bolts shearing is remote. In any event the shearing of bolts is not the cause but the effect of a derailment.

With all bolts entering the heel fillers from the outside, the outside angle bar can be eliminated by using square head bolts with head locks. The thimble, also, can be more readily inserted or renewed. This, of course, would not apply when the stock rail joint is at heel of switch, a practice that is being discontinued.

The increased facility in changing points by having all bolts entering the heel blocks from the outside and the decrease in cost more than offset the slight, if any, sacrifice of safety.

Insert All Bolts from the Outside

By R. L. Haring
Supervisor, Long Island, Jamaica, N. Y.

My opinion on this question is that the increased facility justifies placing the bolts with the nuts all on the inside of the switch point. In the majority of cases where the bolts are sheared off due to a derailment the derailment was caused by an engine running through a switch and then backing over it. In most cases the point is bent and must either be straightened or replaced and a much quicker job can be done if the point can be slipped off the old bolts and a new point installed. This is particularly true in busy yards. Even though no derailment has occurred it is much simpler to change out a worn switch point this way than to drift out one-half the bolts.

Nine Requisites for a Foreman

By C. H. Carpenter

EVERY MAN promoted to a foreman's position should desire to be efficient. Unless a railroad has good foremen it is not only impossible to maintain track to the established standard, but it is also impossible to maintain it so that trains can be operated safely and efficiently over it at all times. Obviously the amount of work that is obtained from track forces and the quality of this work is proportionate to the efficiency of the foremen in charge of these forces.

What makes an efficient track foreman? Let us pick apart the qualities of a good track foreman and see what they consist of.

First: The good foreman has a sound knowledge of track work. It goes without discussion that a foreman must know the ways and means of maintaining track before he is promoted to a foremanship, but the good foreman does not stand still after he is promoted. He keeps on studying and never misses an opportunity to observe the methods employed on lines other than his own. He also keeps thoroughly posted on all instructions issued for his guidance. He reads books and magazines that pertain to his work. Much information can be gathered from these sources that is of inestimable value to him in his daily work.

Second: The good foreman has the ability to handle men. The force of the track foreman is often small, but even if it consists at times of only three or four men, these men must be handled right to get the most and best work out of them. If the foreman does not have the ability to handle his men properly there will be lost motion, poor work and less work done. Nearly every man who is promoted to a foreman's place has the necessary ability to handle men. Nevertheless, the good foreman checks up on himself occasionally to see if he is handling his force in the best manner and is getting the highest efficiency possible from his men.

Third: The good foreman is enthusiastic about his work. Proper interest is vital to success in any line. Every foreman should possess a genuine enthusiasm for his work. He is the "general manager" of his stretch of railroad and the deeper the interest he takes in it the better the results he will obtain. The good foreman is not officious, but he is enthusiastic enough to show his superiors that he is looking after the property that is intrusted to him to the best of his ability.

Fourth: The good foreman, being a good leader, takes a personal interest in his men and does everything he can for their welfare. If there is any dissatisfaction among his men he finds out what is causing it and, if within his power, he removes the cause. He realizes that it is in his power to make his men satisfied or dissatisfied, and he knows that discontented men never do the best work.

Fifth: The good foreman uses judgment and foresight in the planning of work. He always has his work mapped out ahead so that there will be no time lost in looking for something to do. Of course the trackman's work never ends, but often the poor or careless foreman will be at a loss to know just where to put his men to work at odd times and many good hours are practically lost in this way. The good foreman, because of the fact that he "budgets" his work, always knows where to put his men to the best advantage, even for a spare half hour.

Sixth: The good foreman uses diligence in carrying out his plans. Diligence must be applied in carrying out all track work planned; otherwise the value of the planning is lost.

Seventh: The good foreman exercises judgment in giving precedence to work that is to be done. He knows that some work cannot wait and he does this work without waiting. He knows that some work can be put off until some more urgent work is done and he lays his plans to suit the conditions. Sometimes a job is done that has to be done over again because something was neglected before doing it. A stretch of track is surfaced and lined before it is drained. It was the intention of the foreman to drain it the next day or the day after that. The foreman's intentions were good but something happens that prevents it and the days go by and due to bad drainage the track soon has to be surfaced and lined again.

Eighth: The good foreman uses the materials put at his disposal so as to get the greatest amount of good from them. He sees that every rail, spike and bolt, every tie and piece of ballast, and every drain box or piece of tile is used to produce the greatest amount of good.

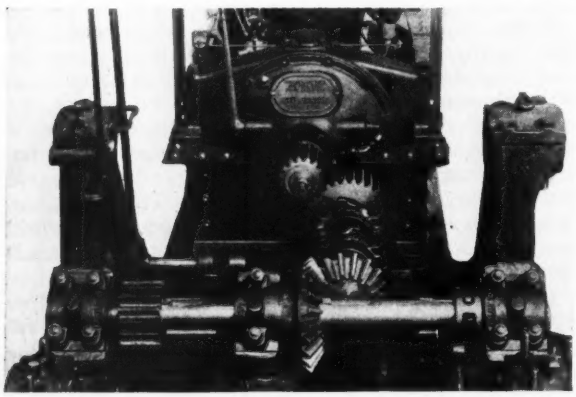
Ninth: The good foreman is loyal to his company. If a foreman is not loyal to the company that employs him and to the officers to whom he reports he cannot be a good foreman. If he is not loyal he cannot expect the men under him to be loyal either to the company or to him.

If a foreman possesses the nine qualities mentioned he is without doubt an efficient foreman. He is a valuable man to the organization of which he is a part. And the stronger these qualities are in a foreman the more he will be worth to his railroad and to himself. Every foreman who is deficient or entirely lacking with respect to some of these qualities should make every effort to correct his shortcomings.

New and Improved Devices

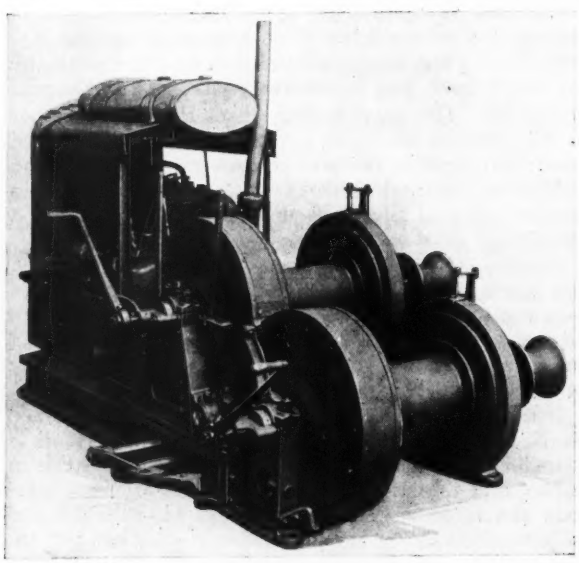
New American Hoist Has Gear Drive

THE AMERICAN Hoist and Derrick Co., St. Paul, Minn., has recently redesigned its gasoline hoist, changing it from chain drive to gear drive. The new hoist is driven by means of spur and bevel gears



The Gear Drive with Drums Removed

with an intermediate longitudinal shaft placed at right angles with the pinion shaft, which corresponds to the crank shaft on a steam hoist, the gasoline motor being mounted lengthwise instead of crosswise on the hoist. The pinion shaft of the hoist has a bevel gear near its center which engages with a bevel pinion on the end of the intermediate longitudinal shaft.



The New Hoist Complete

On the other end of this shaft is a spur gear which engages with the pinion on the engine crank shaft.

The equipping of gasoline hoists with a gear drive instead of a chain drive presents a number of important advantages, among which are speedier shipment of repair parts for both hoist and driving mechanism and ability to change the line speed to meet varying requirements without seriously delaying shipments. However, the principal advantage of the new gear drive over the chain drive is that the power is transmitted directly to the pinion shaft of the hoist which is between the two rear drums and from there to the friction gears by at least two teeth—one to each adjoining friction gear—whereas on the old arrangement the power was transmitted to the rear drum and from there to the rest of the drums by only one gear tooth.

The hoist has the drum equipment of the regular American steam hoisting engine. This means that under the hoist unit system a hoist may be purchased with the number of drums needed for present requirements, as additional drums needed for future requirements can be bolted, one at a time, to the front of the hoist as needed.

A Protection Against Corrosion

MAINTENANCE officers confronted with the problem of protecting railway structures subject to the deteriorating action of brine drippings and corrosive gases will be interested in a product known as Triple A which has been put on the market by the Quigley Furnace Specialties Company, Inc., New York. It was formerly sold as a Na-bep-co product. This material is a solution compounded from coal tar derivatives subjected to careful heat treatment. It is applied with a brush like paint and when dried forms an impervious surface which is said to be secure against cracking, chipping or peeling and highly resistant to the action of corrosive materials.

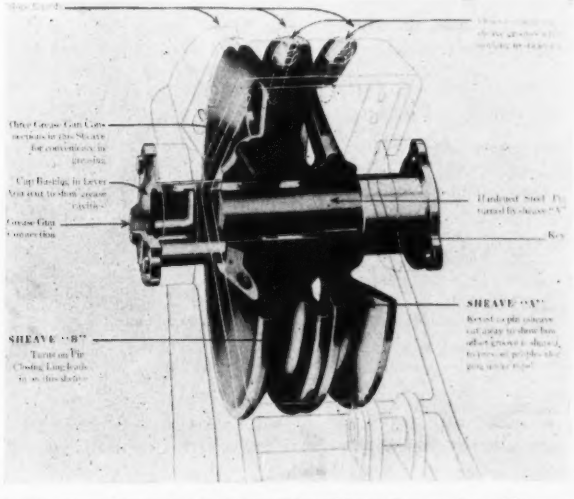
This solution has been put to severe tests. Small porous clay crucibles about 3 in. high and ½ in. in diameter at the top were lined with the Triple A solution after which different ones were filled with a saturated solution of caustic, ammonium fluoride, concentrated prussic acid, arsenious acid and mercuric chloride. After these crucibles were allowed to stand for two weeks, the chemicals were removed. The interiors of the crucibles were examined and no sign of any deteriorating effect of any kind was discovered. There was no leakage through the porous clay which would have indicated at once that the solution had been eaten through by the chemicals. A piece of sheet steel 1/32 in. thick was painted on both sides by the solution and after it had dried, was bent back and forth without showing any signs of cracking.

This solution is applied with a brush on a clean

metal surface, free from grease, dust or oil. It spreads easily, leaving a firm, smooth and elastic surface. The Triple A solution is furnished in several colors, the usual standard base coat being black. Over this black may be applied additional Triple A colors, such as maroon, olive-green, deep-green, yellow, etc. The black solution will cover 300 to 400 sq. ft. of surface per gallon on iron or steel.

New Sheave Arrangement Reduces Bearing Speed on Clam Shell Bucket

THE BLAW-KNOX Company, Pittsburgh, Pa., has introduced an ingenious feature in the design of the lever arm sheaves on its clam shell buckets which reduces the bearing speed by one-half and protects the bearings against the entrance of sand or grit to which these bearings are constantly exposed in the operation of the bucket. It is the opinion of the manufacturer that these changes in design will



A Phantom View of the New Blaw-Knox Lever Arm Sheaves Showing the New Bearings

bring about a marked increase in the life of these bearings. Reference to the illustration in connection with a reading of the following description will give the reader a clear idea of the essential features of the new sheave arrangement.

In operation, sheave A turns at about one-half the speed of sheave B, as it is the second sheave in a block-and-tackle reeving. Instead of turning both sheaves on a short fixed pin, as is the usual practice, the pin itself is revolved at one-half the speed of the closing line by keying it to sheave A. Sheave B, with its extra long bearing (obtained by offsetting the hub of sheave A) turns, of course, at full line speed but it turns on a surface moving at one-half speed in the same direction. Consequently the bearing speed for this sheave is the difference between the full speed of sheave B and the speed of the pin, or about one-half of the speed it would have on a fixed pin.

The large cup bushings effectively prevent wobbling of the sheaves with resultant flange wear. Sand and other abrasive matter is excluded from the bearings. The outside ends have no openings, and oozing of the grease at the inside, as the pin moves slightly (like a piston in a cylinder), seals the bearings effectively. Wherever motion occurs a bushing is provided, and a high pressure "Alemite" gun is used to force grease into the bearing.

With the Associations

The Bridge and Building Association

The members of the executive committee met at Chicago on December 5 to select the committees for the ensuing year. The personnel of these committees will be published in the February issue.

The Roadmasters' Association

The members of the executive committee of the Roadmasters' Association met at Chicago, on December 12. After careful consideration it was decided to hold the next convention at the Auditorium Hotel, Chicago, on September 21-23, 1926. Committees were selected for the ensuing year, the personnel of which will be published in the February issue.

The Wood Preservers' Association

The American Wood Preservers' Association will hold its twenty-second annual convention at the Hotel Cleveland, Cleveland, O., on January 26-28. The program is as follows:

Tuesday Morning

Opening exercises.
Report of secretary-treasurer.
President's address.
Report of Publications Committee.....
E. J. Stocking (Secretary, A. W. P. A.), Chairman
Report of Committee on Revision of Manual.....
John Foley (Forester, Penna.), Chairman
Address: Wood Preservation in Relation to Forestry.....
Aldo Leopold, assistant director Forest Products Laboratory, Madison, Wis.

Tuesday Afternoon

Address.....C. E. Denney, vice-president and general manager, N. Y., C. & St. L.
Report of Committee 4—Preservatives.....L. C. Drefahl, (Grasselli Chemical Company), chairman
Supplementary reports:
"A Method of Calculating Viscosity of Mixtures of Creosote and Petroleum".....E. Bateman, Forest Products Laboratory, Madison, Wis., and Mr. Baechler
"Two Visual Methods for Testing the Penetration of Sodium Fluoride in Treated Wood".....
E. Bateman and C. Henningsen
Address: Beta Naphthol as Wood Preservative.....
Galen Wood, chemical engineer, Philadelphia Pa.
Report of Committee 5-1—Treatment of Ties.....
W. E. Jackson, superintendent, Texas Tie & Lumber Preserving Co., Somerville, Tex., chairman

Wednesday Morning

Report of Committee 5-1-1—Treatment of Fir Ties.....
M. M. Rabourn, superintendent, timber treating plant, Union Pacific, Laramie, Wyo., chairman
Report of Committee 5-2-1—Treatment of Car Lumber...
C. M. Taylor (superintendent treating plant, Central of New Jersey, Port Reading, N. J., chairman
Report of Committee 5-4-1—Treatment of Fir Piling.....
H. E. Horrocks (manager, Pacific Creosoting

Company, Seattle, Wash.), chairman
Address: The Relationship of the Treating and Signal Departments.....By Thos. S. Stevens, signal engineer, Atchison, Topeka & Santa Fe
Address: The Effect of Temperature and Viscosity of Preservative Oils on Penetration and Absorption.....
J. D. McLean, Forest Products Laboratory, Madison, Wis.

Wednesday Afternoon

Address: Does the Wood Preserving Industry Need Publicity?.....E. T. Howson, western editor, Railway Age
Report of Service Bureau Board.....
R. S. Manley (president, Texas Creosoting Company, Orange, Tex.), chairman
Address: Wood Preservation and the Forestry Schools...
Reuben W. Smith, assistant professor, New York College of Forestry, Syracuse, N. Y.
Report of Committee 5-2-2—Non-Pressure Treatment of Poles.....J. D. Burnes (inspector Page & Hill Co., St. Paul, Minn.), chairman
Report of Committee 5-9—Inspection.....
F. C. Krell (assistant forester, Pennsylvania System, Philadelphia, Pa.), chairman
Report of Committee 7-1—Tie Service Records.....
Z. M. Briggs (assistant engineer maintenance, Pennsylvania, Pittsburgh, Pa.), chairman

Thursday Morning

Report of Committee 7-9—Utilization and Service of Treated Posts.....Wm. Bell (manager, Long-Bell Lumber Company, Shreveport, La.), chairman
Report of Committee 8-1—Steam Treatments.....
Geo. M. Hunt (in charge of wood preservation, Forest Products Laboratory, Madison, Wis.), chairman
Closing Business

The Tie Producers' Association

The National Association of Railroad Tie Producers will hold its annual convention at the Hotel Cleveland, Cleveland, O., on January 28 and 29.

Thursday Afternoon, January 28

Convention called to order at 2 p. m. by Howard Andrews, president.

Address by John J. Bernet, president, N. Y., C. & St. L.

Reports of officers.

Address on The Business Outlook, by John C. Howell, chief of commodity department, Brookmire Economic Service, New York.

Address on The Tie Siding, How and Where to Sell It, by Wilson Compton, secretary-manager, National Lumber Manufacturers' Association, Washington, D. C.

Reports of committees on Finance, Membership, Publicity and Transportation.

Reports on conditions in the tie industry by the district officers.

Report of Sub-committee on Ties, American Engineering Standards Committee, by E. E. Pershall, representative.

Thursday Evening, 6:30 P. M.

Annual dinner with address by Col. W. B. Greeley, forester, United States Department of Agriculture, Washington, D. C.

Friday, January 29, 10 A. M.

Address on The Importance of the Tie Industry in our Program of Forest Thrift, by R. D. Garver, assistant chief, Section of Industrial Investigations, Forest Products Laboratory, Madison, Wis.

Address on Cross Ties in Europe, by Dr. Hermann von Schrenk, consulting timber engineer, St. Louis, Mo.

Address on Tie Specifications and the Changes They Have Wrought, by E. R. Ross, Marsh & Truman Lumber Co., Chicago.

Friday, 2 P. M.

Address on The Effect of Railroad Consolidations, by E. T. Howson, editor Railway Engineering and Maintenance, Chicago.

Address on Future Cross Tie Requirements of the Railroads, by J. H. Waterman, superintendent of timber preservation, C., B. & Q., Galesburg, Ill.

Closing business.

The Material Market

THE MATERIAL MARKET at the end of 1925 presents almost exactly the same aspect as at the end of 1924. A comparison of prices discloses a remarkable lack of distinct variations. Track materials and reinforcing bars are on substantially the same basis as last year. Wire and wire products and the three structural steel items, namely, plates, shapes and bars are slightly lower. Prices for Southern pine vary but little from those in December, 1924, while the quotations for Douglas fir are moderately lower.

The healthy demand for iron and steel products noted in last month's issue has continued throughout the month of December but there has been no increase in the volume of orders which would form the basis for an advance in prices. In fact, efforts on the parts of the mills to establish higher prices have been without result and, as seen in the table below, the prices remain substantially as quoted for November.

PRICES PER 100 LB.

	Pittsburgh November	Chicago November	Pittsburgh December	Chicago December
Track spikes	$2.80 to $3.10	$2.80 to $3.10	$2.80 to $3.10	$2.80 to $3.10
Track bolts	3.90 to 4.25	3.90 to 4.00	3.90 to 4.25	3.90 to 4.00
Angle bars	2.75	2.75	2.75	2.75
Tie plates, steel	2.35 to 2.50	2.35 to 2.50	2.35 to 2.50	2.35
Boat spikes	3.25	3.25	3.25	3.25
Plain wire	2.50	2.55	2.50	2.55
Wire nails	2.65	2.70	2.65	2.70
Barb wire, galv.	2.35	3.40	3.35	3.40
C. I. pipe, 6 in. to 12 in., ton		50.20		50.20
Plates	1.90 to 2.00	2.10	1.90 to 2.00	2.10
Shapes	1.90 to 2.10	2.10	1.90 to 2.10	2.10
Bars, soft steel	2.00 to 2.10	2.10	2.00 to 2.10	2.10
Rivets, struct.	2.60	2.75	2.60	2.75
Conc. bars, billet	2.00 to 2.10		2.00 to 2.10	
Conc. bars, rail		2.00 to 2.10	1.80 to 1.90	2.00 to 2.10
Rail, per gross ton, f.o.b. mills		43.00		43.00

The demand for scrap is not as large as the supply. Consequently there have been some reductions in current quotations for scrap, as indicated in the table below.

PRICES PER GROSS TON AT CHICAGO

	November	December
Relaying rails	$26.00 to $31.00	$26.00 to $31.00
Rails for rerolling	19.50 to 20.00	18.50 to 19.00
Rails less than 3 ft. long	19.75 to 20.25	19.00 to 19.50
Frogs and switches cut apart	18.50 to 19.00	17.25 to 17.75
Steel angle bars	19.50 to 20.00	18.50 to 19.00

The lumber market is quiet, although inquiries from railroads, primarily for bridge timbers, have created some activity. In the list of quotations on Southern pine given below it will be seen that the prices for the smaller items have remained stationary while those for timbers show an appreciable advance. Quotations from the northwest are stationary.

SOUTHERN PINE MILL PRICES

	November	December
Flooring, 1x4, B and B flat	$49.50	$49.54
Boards, 1x8, No. 1	33.96	35.01
Dimension, 2x4, 16, No. 1, common	28.36	28.24
Dimension, 2x10, No. 1, common	32.62	29.15
Timbers, 4x4 to 8x8, No. 1	22.88	26.84
Timbers, 3x12 to 12x12, rough	40.20	42.58

DOUGLAS FIR MILL PRICES

Flooring, 1x4, No. 2, clear flat	$27.00	$27.00
Boards, 1x8, 6 to 20, No. 1, common	15.50	15.50
Dimension, 2x4, No. 1, Common	17.00	17.00
Dimension, 2x10, 16, No. 1, common	16.50	16.50
Timbers, 6x6 to 8x8, No. 1, common	21.00	21.00
Timbers, 10x10 to 12x12, rough	18.00	18.00

The prices for Portland cement per barrel in carload lots, not including package, quoted below, are the same as those given last month.

New York	$2.15	Minneapolis	$2.32
Pittsburgh	2.09	Dallas	2.05
New Orleans	2.40	Denver	2.84
Chicago	2.10	San Francisco	2.31
Cincinnati	2.37	Montreal	1.80

News of the Month

The Chicago & Eastern Illinois is offering $100 for a name which can be used as a trademark for the railroad. A prize of $50 is also offered for the second best suggestion. T. C. Powell, president, is endeavoring to secure a nickname or trademark which will catch the eye, be expressive and be adopted by the public. The name must indicate the position and service of the railroad.

J. M. Davis, president of the Delaware, Lackawanna & Western Railroad, has been elected a member of the board of directors of the American Railway Association, to succeed W. H. Truesdale, chairman of the board of managers of that company, resigned. Fairfax Harrison, president of the Southern Railway has been elected to fill the vacancy caused by the death of Julius Kruttschnitt, chairman, executive committee, Southern Pacific Company.

The Public Service Commission of New York having approved the plans of the New York Central for electrification and the Transit Commission having approved the plans for the elimination of most of the important grade crossings, on the upper west side of New York City as far south as Seventy-second street, work on this project has been begun by the railroad company. The improvement is estimated to cost $30,000,000 and it should be completed within three years.

Car loadings of 1,020,873 and 1,008,824 for the weeks ending December 5 and December 12 respectively, the first instances in history of loadings in excess of 1,000,000 in December, bring the cumulative total car loadings for the first 50 weeks of 1925 to 49,508,997, as compared with 46,986,455 for the first 50 weeks of 1924 and 48,319,067 for the same period of 1923. As the records now stand there were 20 weeks in 1925 during which the cars loaded exceeded 1,000,000 cars, only one week less than the previous high record of 21 weeks for 1923.

According to records of the treasurer of the United States, the net cash expenditures on account of federal control up to June 30, 1925, amounted to $1,799,920,784. Deducting from this total the amount of obligations of carriers held in the treasury the net cost of federal control to the United States is $1,664,683,784. On June 30, 1925, the government held railroad obligations to the amount of $316,300,324, as against $449,377,995 on June 30, 1924, the difference representing the acquisition of additional obligations during the year less the amount of obligations sold.

The Reading has made application to the Pennsylvania State Commission for authority to operate bus lines in that state through the organization of the Reading Transportation Company capitalized at $1,000,000. Among the reasons offered in justification of the operation of busses by the railroad, rather than by independent bus lines, is the elimination of duplicate overhead expense, the advantage of a responsible management insuring all-winter service and thorough reliability, the elimination of wasteful competition and provision for through service with established rail-bus connections.

Operating revenues for Class 1 railroads covering the 10 months ending October, 1925, totaled $5,129,774,465, as compared with $4,976,596,575 in 1924. Operating expenses for the first 10 months of 1925 totaled $3,809,091,395, as compared with $3,803,869,288 in the first 10 months of 1924. Net operating revenues for this period in 1925 totaled $1,320,683,070, as compared with $1,172,727,287 in 1924. The net railway operating income for the first 10 months of 1925 totaled $935,047,508, as compared with $806,666,561 for the same period in 1924. Expenditures for maintenance of way and structures for the 10 months of 1925 totaled $694,658,687, as compared with $677,366,045 in 1924.

The annual report of the Interstate Commerce Commission includes the recommendation that the consolidation provisions of the transportation act be amended to omit the requirement that a complete plan of consolidation must be prepared by the commission. The commission feels that better results will be obtained if the process of consolidation be permitted to develop under the guidance of the commission in a more normal way. The commission also recommends that the act be amended to provide for the punishment of any person offering or giving an employee of a carrier money to influence his action in any way with respect to car service and to provide for the punishment of the guilty employee.

The Boston & Maine has been authorized by the Interstate Commerce Commission to abandon various light traffic branches aggregating 57.8 miles in Massachusetts and New Hampshire out of a total mileage of 165.46 miles which the railroad had asked leave to abandon in those two states. One of the reasons upon which the railroad based its request to abandon the lines was that most of these branches were built for competitive reasons which were eliminated by the acquisition of all of the lines into one system, but the principal reason for desiring to abandon the lines was that they were being operated at a loss owing primarily to motor truck and bus service over paralleling highways.

Among bills which have been introduced since the opening of Congress are one to prohibit the use of wooden passenger cars between or in front of steel cars; a bill to prohibit a Pullman surcharge and a bill to require certificates of public convenience and necessity from the Interstate Commerce Commission only for new lines which cross state lines. Several bills have been introduced which call for amendments of the fourth section of the Interstate Commerce Act, otherwise known as the "long and short haul" clause. One bill provides for the appointment of Interstate Commerce commissioners by districts instead of from the country at large as at present is prompted by the demand of the southern states for representation on the commission.

The annual report of the secretary of the interior definitely disapproves the suggestion recently made that the Alaska railway be transformed into a highway because of the failure of that railroad to earn its operating expenses. "Automobiles require hard surface roads," says the report. "These could hardly be built in Alaska for less than $50,000 a mile for surfacing and widening of the railroad right-of-way. There are no such roads at present in Alaska and the effect of extremely cold weather on them is unknown. The alternate freezing and thawing of the surface in Alaska would be disastrous to truck roads, whether hard-surfaced or not. Gravel-surfaced roads are now impracticable in Alaska for heavy trucks except in periods when the roads are frozen.

"Automobile traffic would encounter similar obstructions from slides in winter, as do the railroads; their removal would be more expensive than similar clearings from the railroad right-of-way."

Labor News

Trackmen Demand Switchtender's Pay for Handling Switches

While an interlocking plant at the end of double track on the Baltimore & Ohio was out of commission while undergoing repairs, two trackmen were employed to open and close the switches by hand, under the direction of the operator. This was done to save the time of the operator in going to and from the switches. The employees contended that as they were handling switches their responsibility was as great as that of a switchtender and that they should be given a switchtender's rate of pay, 55 cents an hour, instead of a trackman's rate of 39½ cents. The carrier contended that the responsibilities were not as great as those of a regular switchtender and that the work was not as arduous, since the throwing of switches for main line trains averaging 37 per 24 hours did not compare with the work required of a switchtender in yard operation. Furthermore, the work of the two trackmen was constantly under the supervision of the block operator. The decision of the board denied the claim of the employees.—Decision No. 3976.

New Order Refused Working Agreement

A complaint was filed before the United States Railroad Labor Board by the Order of Skilled Railway Maintenance of Way Employees in which it was stated that "the majority of employees above the rank of laborer in the maintenance of way department of the Chesapeake & Ohio system" had affiliated themselves with that organization and had requested a conference with the management for the purpose of making a working agreement and revising rates of pay, but that the railroad had declined to enter into negotiations with it. The carrier took the position that it already had an agreement with the United Brotherhood of Maintenance of Way Employees and that it had not been furnished with definite information as to the actual number of employees of the classes for which representation was claimed by the new organization other than a list of 348 names appearing on a petition submitted by this organization.

The decision of the board was that the Order of Skilled Railway Maintenance of Way Employees had not made a sufficient showing to justify the authorization of a ballot for the purpose of determining representation and its claim was therefore denied.—Decision No. 3977.

New Rule Covering Work Not Continuous With the Regular Tour of Service

In Decision No. 3535 dated May 13, 1925, on a case involving the Chicago & North Western and the Brotherhood of Maintenance of Way Employees with respect to the interpretation of Rule 30, the case was remanded with the direction that the employees and the carrier negotiate a new rule. However, because of failure to agree two rules were submitted to the board, one by the employees and the other by the carrier. The employees' proposal was as follows:

"Employees who have completed their assigned work period for the day may be released from duty and required to return for further service and paid as if on continuous duty, providing that such employees are so notified at time released."

The rule submitted by the carrier was as follows:

"Employees who have completed their work period for the day, and released from duty, required to return for further service within one hour from time of release, may, if conditions justify, be compensated as if on continuous basis."

Each side offered objections to the rule submitted by the other. The board decided this case by drafting a new rule to be incorporated in and made a part of the arrangement between the two parties to take the place of Rule 30 previously in effect, the new rule being as follows:

"Except as otherwise provided in these rules, employees notified or called to perform work not continuous with the regular work period, will be allowed a minimum of three hours for two hours work or less. If held on duty in excess of two hours, time and one-half time will be allowed on the minute basis."—Decision No. 3978.

Personal Mention

General

R. C. Miller, division engineer of the New York division of the Pennsylvania, with headquarters at Jersey City, N. J., has been promoted to superintendent of the Schuylkill division, with headquarters at Reading, Pa. **C. E. Brinser,** assistant superintendent of the Indianapolis division, with headquarters at Louisville, Ky., and for a number of years an officer in the maintenance of way department, has been promoted to superintendent of the Elmira division, with headquarters at Elmira, N. Y., succeeding **R. D. McKeon,** transferred to Chicago as general agent and superintendent of the Chicago Terminal division.

H. H. Garrigues, superintendent of the Cleveland and Pittsburgh division, Central region of the Pennsylvania, with headquarters at Cleveland, Ohio, has been promoted to general superintendent of the Eastern Pennsylvania division, with headquarters at Harrisburg, Pa., succeeding **A. M. Parker,** who died a few weeks ago, as noted elsewhere. Mr. Garrigues was born on September 4, 1881, at Harrisburg, Pa., and entered the service of the Pennsylvania as a rodman in February, 1901, immediately after graduating from Harverford College. He was promoted to transitman at Altoona. Pa., in September, 1903, and in January, 1904, became assistant supervisor in the office of the general superintendent at Altoona, a position he held at that place and elsewhere until December, 1908, when he was promoted to supervisor. He served successively as supervisor of the Allegheny division, the West Jersey & Seashore, in the office of the general manager, in the office of the valuation engineer, on the Baltimore division and on the Philadelphia division until December, 1917, when he was promoted to division engineer of the Trenton division. He was transferred to the Philadelphia Terminal division in January, 1919, and in March, 1920, was promoted to engineer maintenance of way of the Southern division. He became a superintendent in May, 1920, and was serving as superintendent of the Cleveland and Pittsburgh division, Central region, with headquarters at Cleveland, Ohio, at the time of his promotion.

Samuel M. Felton, whose election as chairman of the board of directors of the Chicago Great Western was reported in the December issue, was born at Philadelphia, Pa., on February 3, 1853, and entered railway service in August, 1868, as a rodman on the Chester Creek railroad. He was later promoted to leveler and assistant engineer and engineer in charge of surveys and in 1873 was appointed chief engineer of the Chester & Delaware. In August, 1874, he entered the operating department, when at the age of 21 he was appointed general superintendent of the Pittsburgh, Cincinnati & St. Louis, now a part of the Pennsylvania. In September, 1881, his jurisdiction was extended over the Little Miami and the Cincinnati & Muskingum Valley. He was appointed general manager of the New York & New England in January, 1882, and was promoted to assistant to the president in February, 1884. In November, 1885, he went with the New York, Lake Erie & Western as vice-president in charge of the traffic department, resigning in November, 1890, to become president of the East Tennessee, Virginia & Georgia. He was elected president of the Cincinnati, New Orleans & Texas Pacific, now a part of the Southern, in November, 1890, and was appointed receiver of the road in March, 1893. In November, 1895, he was elected also president of the Alabama Great Southern.

Samuel M. Felton

He was also receiver of the Columbus, Sandusky & Hocking from June, 1897, to September, 1899. From September, 1899, to December, 1907, he was president of the Chicago & Alton, at the latter date being elected president of the Mexican Central, where he remained for two years until April, 1909, when he was elected chairman of the board of directors of the Tennessee Central. Mr. Felton became connected with the Chicago Great Western in August, 1909, when he was elected president, which position he has held continuously until his present election as chairman of the board of directors. However, he has engaged in many other interesting activities in addition. From September, 1912, to August, 1914, he acted as receiver of the Pere Marquette, being also president of the corporation from January, 1913, to June, 1914. He was elected chairman of the Western railways publicity committee in 1919 and has held that position up to the present time.

Colonel N. L. Howard, who succeeded Mr. Felton as president of the Chicago Great Western, was born on March 9, 1884, at Fairfield, Iowa, and received an engineering education at the United States Military Academy at West Point, N. Y., from which he graduated in 1907. In September of that year he entered railway service as a civil engineer on the Chicago, Burlington & Quincy, later being promoted to trainmaster. Subsequent promotions took Col. Howard through the grades of assistant superintendent and division superintendent, in which capacities he served on both the Burlington and Hannibal divisions. He entered the United States Army in May, 1917, receiving a commission as lieutenant colonel of the Thirteenth Railway Engineers and from August, 1917, to the spring of 1918 he was on duty with the director general of transportation in France. He was later placed in command of the Thirteenth Railway Engineers and was promoted to the rank of colonel in July, 1918. Col. Howard retired from service in May, 1919, and returned to railway service as assistant to the federal manager of the Chicago, Burlington & Quincy. In November, 1919, he was promoted to general superintendent of the Missouri district at St. Louis, Mo. He remained there until July, 1923, when he was promoted to superintendent of transportation, with headquarters at Chicago. Col. Howard was appointed general manager of the Chicago Union Station Company in August, 1924, and he held that position until his recent election as president of the Chicago Great Western.

Colonel N. L. Howard

Track

S. H. Jones and **A. C. Everett** have been appointed roadmasters of the Seaboard Air Line, with headquarters at Tampa, Fla., and **A. J. Bailey** has been appointed roadmaster with headquarters at Waldo, Fla.

B. E. Haley, general roadmaster on the Atlantic Coast Line, with headquarters at Rocky Mount, N. C., has been transferred to Lakeland, Fla., succeeding **T. J. Joyner,** who has been transferred to Rocky Mount, N. C.

Ben Rippenhagen has been appointed acting roadmaster on the Matagorda division of the Gulf, Colorado & Santa Fe, with headquarters at Sealy, Tex., succeeding **R. M. Cargile,** who has been assigned to other duties.

Calvin Hankins has been appointed roadmaster of the Fourth district of the Butte division of the Great Northern, with headquarters at Great Falls, Mont., succeeding **John Wallin,** who has been granted a 60 days' leave of absence because of illness.

Frank Svec, whose promotion to track supervisor on the First district of the Central division of the Minneapolis & St. Louis, with headquarters at Ft. Dodge, Iowa, was reported in the December issue, was born in Jamica, Bohemia, on January 6, 1887, and entered railway service as a section laborer on the Minneapolis & St. Louis on April 1, 1907. On November 1, 1913, he was promoted to section foreman, which position he was holding at the time of his promotion to track supervisor.

N. A. Richards, whose promotion to roadmaster on the Western Pacific, with headquarters at Elko, Nev., was reported in the December issue, was born in October, 1878, at Roseburg, Ore., and entered railway service in October, 1902, as a section laborer on the Portland division of the Southern Pacific. From July, 1904, to July, 1906, he served as assistant extra gang foreman and timekeeper on the same division, in the latter year being promoted to section foreman, serving in this capacity on the Portland, Sacramento and Shasta divisions until July, 1917, when he left that road to enter the services of the Western Pacific as a section foreman. He was holding this position at the time of his recent promotion to roadmaster.

J. V. Inabinet, bridge foreman on the Seaboard Air Line, has been promoted to master carpenter, with headquarters at Tampa, Fla. He was born on June 15, 1893, at Swansea, S. C., and entered railway service on October 25, 1911, as a laborer in a carpenter force on the Seaboard Air Line, his entire railway service being with that road. After successive promotions he was made assistant foreman in a carpenter gang in 1913 and was later transferred to a bridge gang, serving as an assistant foreman until June 6, 1917, following which he was in military service until March, 1919, when he again became assistant foreman in a bridge gang. He was promoted to bridge foreman in June, 1920, and was holding that position at the time of his recent promotion to master carpenter.

W. H. Haggerty, track supervisor on the Hartford division of the New York, New Haven & Hartford, with headquarters at Hartford, Conn., has been transferred to the Boston division, with headquarters at Boston, Mass., succeeding **H. A. Pellett,** who has been transferred to the Central New England, a subsidiary of the N. Y., N. H. & H., with headquarters at Winsted, Conn., succeeding **Edward Conley,** who has been transferred to the Hartford division, with headquarters at Hartford, Conn., succeeding Mr. Haggerty. **Michael Sullivan,** track supervisor on the Worchester branch of the Providence division, at Providence, R. I., has been given charge of the Providence terminal, with the same headquarters, succeeding **Reuben Armstrong,** who died on November 6 as noted elsewhere. **John Gigliotti,** extra gang foreman, has been promoted to track supervisor on the Worcester branch, with headquarters at Providence, succeeding Mr. Sullivan.

Mr. Gigliotti was born on December 4, 1884, at Tomaini, Italy. He entered railway service as a work train laborer on the Lehigh Valley on May 2, 1901, where he remained until July 10, 1904. On that date he became a section laborer on the New York, New Haven & Hartford, holding this position until June 22, 1906, when he was promoted to assistant foreman. On May 18, 1909, he was promoted to section foreman and served as work train foreman and extra gang foreman, holding the latter position at the time of his promotion to track supervisor.

Herbert L. Roblin, whose promotion to roadmaster on the Regina division of the Canadian National, with jurisdiction over the Lampman, Bengough and Bienfait sub-divisions, with headquarters at Radville, Sask., was reported in the December issue, was born on September 28, 1890, at London, Ont. He graduated from the University of Toronto in 1911 and completed a post-graduate course in 1913. From 1907 to 1908 he worked in the shops of the Canadian Pacific at London, Ont., and in the summers of 1909 and 1910 served as a chairman with the resident engineer, being promoted to instrumentman in 1911. He left railway service in 1913 and for two years was engaged in various engineering work in British Columbia, other than railway work. From 1915 to 1919 he served in France with the Canadian Expeditionary Force, returning in August, 1919, to become resident engineer in the construction department of the Canadian National at Winnipeg and Edmonton, which position he was holding at the time of his recent promotion to roadmaster.

M. H. Murphy, supervisor of track on the Chicago & Alton, with headquarters at Mexico, Mo., has been promoted to division roadmaster, with headquarters at Slater, Mo., succeeding **James McCabe,** resigned. **Earl Porter,** extra gang foreman on the Western division, has been promoted to supervisor of track at Mexico, Mo., succeeding Mr. Murphy. Mr. Murphy entered the services of the Chicago & Alton as a section laborer in June, 1896, and was promoted to section foreman in May, 1898. From 1901 to 1910 he served in turn as a clerk for the division roadmaster and the supervisor of bridges and buildings, during this period completing a correspondence course in engineering. In June, 1909, he served as general foreman on second-track construction and in September of that year was promoted to track supervisor at Mexico, Mo., where he was serving at the time of his recent advancement.

Engineering

J. E. Hogan has been appointed assistant division engineer of the Chesapeake & Ohio, with headquarters at Hinton, W. Va., succeeding W. H. Hanchett, who has resigned.

W. A. Roderick, whose promotion to engineer maintenance of way on the Wheeling & Lake Erie, with headquarters at Brewster, Ohio, as reported in the December issue, was born at Navarre, Ohio, and entered railway service as a timekeeper in the construction department of the Wheeling & Lake Erie in 1905. He served in various capacities in the engineering and construction department, before being appointed rail inspector on March 13, 1922, which position he held until September 15, 1922, when he became an assistant engineer. He was appointed district roadmaster on April 1, 1924, and held this position until the time of his promotion to engineer maintenance of way with headquarters at Brewster, Ohio, as noted above.

W. A. Roderick

G. W. Snyder, assistant to the stores manager of the Pennsylvania, with headquarters at Philadelphia, Pa., has been appointed assistant chief engineer in charge of maintenance, a newly created position. Mr. Snyder was born at Pottsville, Pa., on January 9, 1866, and was educated at Lehigh University, entering the service of the Pennsylvania on November 1, 1884, as a rodman on the Renovo division. He was promoted to assistant supervisor of the same division on January 1, 1886, and in August, 1890, was promoted to supervisor. On June 10, 1897, he was appointed supervisor on the Northern Central at Baltimore, and three years later was transferred to the Altoona yard. He was promoted to division engineer of the Monongahela division in January, 1901, and in June, 1903, was transferred to the Pittsburgh division. On April 1, 1907, he was advanced to principal assistant engineer of the Western Pennsylvania division. In October, 1917, he was made assistant engineer maintenance of way, and served in that position until April, 1919, when he was appointed general storekeeper of the Eastern region, with headquarters at Philadelphia. In March, 1924, he was made assistant to the stores manager, with the same headquarters, which position he was holding at the time of his recent appointment.

G. W. Snyder

H. O. Kaigler has been appointed division engineer of the newly formed West Florida division of the Seaboard Air Line, and will also serve in the same capacity for the Tampa & Gulf Coast and the Tampa Northern.

William Elmer, superintendent of the Middle division of the Pennsylvania, with headquarters at Altoona, Pa., has been appointed special engineer on the staff of the chief engineer, with headquarters at Philadelphia, Pa.

Obituary

Rueben Armstrong, track supervisor of the Providence terminals of the New York, New Haven & Hartford, died on November 6.

Alexander M. Parker, general superintendent of the Eastern Pennsylvania division of the Pennsylvania, and for 20 years a member of the maintenance of way and construction departments, died suddenly of apoplexy at his home in Harrisburg, Pa.

John C. Patterson, for nearly 30 years connected with the engineering department of the Great Northern, who died in Los Angeles, Cal., on November 6, was born at Lawrence, Mass., on March 10, 1858, and graduated from the Maine State College with the degree in civil engineering in 1878. He entered railway service in 1880 as an assistant engineer on the St. Paul, Minneapolis & Manitoba, now a part of the Great Northern, being later employed in a similar capacity on new lines of the company in Minnesota and North Dakota and on the Northern Pacific, surveying and constructing branch lines in the state of Washington. After several years service as resident engineer of the Montana Central, and later in charge of construction of the Butte, Anaconda & Pacific, Mr. Patterson was transferred by the Great Northern to St. Paul as resident engineer in March, 1902, being promoted to principal assistant engineer in March, 1903. On January 1, 1906, he was promoted to assistant chief engineer, and held that position until May 1, 1913, when he resigned to take charge of several construction projects for A. Guthrie & Co., contractors and engineers of St. Paul. From 1917 to 1921 Mr. Patterson was employed by the Great Northern as assistant engineer on special work, mostly in connection with federal valuation. He retired from active service in December, 1921.

Frank A. Merrill, chief engineer of the Boston & Maine, died at his home at Lynn, Mass., on December 21, after a long illness. Mr. Merrill was born on September 1, 1867, at Concord, N. H., and graduated from the Chandler Scientific department of Dartmouth college in 1878. He received his early railway training on the Concord railroad, the Boston, Concord & Montreal and the Northern railroad, being employed first during summer vacations and permanently following his graduation from Dartmouth. He became chief engineer of the Concord railroad in 1885, and in 1890 was appointed chief engineer of the Concord & Montreal, continuing in that capacity until that road was merged with the Boston & Maine in 1895, when he was appointed assistant chief engineer of the Boston & Maine. From 1911 to 1914 he was division engineer in charge of the Southern division, and in 1914 was promoted to engineer maintenance of way, in which capacity he served until his advancement to chief engineer on June 1, 1924. Mr. Merrill was engaged in private engineering practice for many years in addition to his service with the railroad.

The signal department employees of 16 railways were denied requested increases in wages by the Railroad Labor Board in a decision handed down on December 15, which remanded the case to the parties to it. The board says that 56 per cent of the signal department employees now receive rates of pay in excess of those established by the board. These increases, granted by the managements, varying so much in amount as to indicate that local conditions were the most important consideration in the awards.

Construction News

The Atchison, Topeka & Santa Fe will remodel its roundhouse at Winslow, Ariz., to increase its depth. Improvements in terminal facilities at Phoenix, Ariz., are also contemplated. A contract has been awarded to the Sumner Sollitt Company, Los Angeles, Cal., for the construction of a two-story office building as an addition to the freight house at Fresno, Cal., Plans have been prepared for the construction of one-story passenger station, 176 ft. by 40 ft., at Riverside, Cal. A contract has been awarded to Jerome A. Moss, Chicago, Ill., for the construction of a 37-ft. by 300-ft. office building in connection with the fruit terminal at Chicago, to cost $100,000.

The Atlantic Coast Line has been authorized by the Interstate Commerce Commission to construct an extension from Perry, Fla., to Monticello, 41 miles, at an estimated cost of $1,424,000.

The Boston & Maine has awarded a contract to the John H. Proctor & Co., Boston, Mass., for the furnishing of 3 unloading towers and a distributing bridge at Mystic Wharf, Boston. to cost about $375,000. This company has also authorized the construction of a coal handling and storage plant at Mystic Wharf, to cost about $450,000.

The Central of New Jersey has awarded a contract for the construction of the sub-structure for bridge No. 8, Allentown Terminal Railroad, to Richards & Gaston, Inc. The cost i estimated at $52,157.

The Chesapeake & Ohio is reported to be making surveys in contemplation of the construction of a 28-mile branch line from a point near Pikeville, Ky., along the Leoisa river to the Kentucky-Virginia state line.

The Chicago, Rock Island & Pacific has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of a two-story freighthouse, 40 ft. by 260 ft., in Kansas City, Mo., reported in the December issue.

The Florida East Coast has awarded a contract to the C. G. Kershaw Contracting Co., Birmingham, Ala., for grading, bridges and culverts on the line from Bunnell, Fla., to Daytona. A contract has been awarded to Reid & Lowe, Birmingham, Ala., for grading, bridges and culverts on the line from Bonaventure to Grant. A contract has also been awarded to the Union Bridge & Construction Company, Kansas City, Mo., for a bridge at Crane Creek, Melbourne, Fla., and one to Reid & Lowe for a bridge at Elbow Creek, Eau Gallie, Fla.

The Great Northern has authorized the construction of a passenger station and extensive yard facilities at Glacier National Park, Mont., to cost approximately $100,000. The contract for the construction of a tunnel eight miles long through the Cascade mountains to reduce grades and shorten the line by nine miles has been awarded to A. Guthrie & Co., St. Paul, Minn. The eastern entrance of the tunnel will be at Berne, Wash., and the western entrance near Scenic.

The Illinois Central has awarded a contract to the Federal Engineering Company, Chicago, for heating and plumbing facilities in the locomotive shop, blacksmith shop, office building and tin and electric shop being constructed at Paducah, Ky. A contract has also been awarded to the Gould Construction Company, Davenport, Ia., for track elevation and subway construction at Jackson, Miss. The construction of a water station and related facilities at Xenia, Ill., on this company's Edgewood cut-off between Edgewood, Ill., and Metropolis, has been authorized. A contract for the construction of a reservoir and pipe line, to cost approximately $70,000, has been awarded to the Railroad Water & Coal Handling Company, Chicago. Bids are being received for the construction of the water station.

The Mexicali & Gulf has awarded a contract to Welch & Stewart, San Francisco, Cal., for the grading of the second unit, seven miles long, of the projected line from Calexico, Cal., to the Gulf of California, a distance of 135 miles.

The New York Central has awarded a contract to the Frederick Snare Corporation, New York, for the construction of column foundations for a viaduct in New York at an estimated cost of $150,000. A contract for the construction of a passenger station at Canton, N. Y., to cost approximately $52,000, has been awarded to the Edw. J. Duffy Company, Inc., Weehawken, N. J. A contract for bridge steel for a bridge at Woodland, Pa., has been awarded to the Railroad Supply Company, New York, at an estimated cost of $49,000. Plans have been prepared for the construction of a one-story locomotive testing shop at Elkhart, Ind., to cost $65,000.

The Norfolk & Western is planning extensions and additions to its yards at Williamson, W. Va., provision for a pull out track for the eastbound yard and additional track facilities between the west end of the yard and the passenger station involving an estimated expenditure of approximately $1,700,000. The second phase of the work involves engine terminal facilities, the estimated cost of which is about $800,000.

The Northern Pacific and the **Oregon-Washington Railroad & Navigation Company** have applied to the Interstate Commerce Commission for authority for the construction by the Northern Pacific of 38 miles of line from Oro Fino in Clearwater county, Idaho, to be jointly operated by the two railroads.

The Pennsylvania has awarded a contract to the Shoemaker Bridge Company, Philadelphia, Pa., for the fabrication and erection of the steel superstructure of the American Railway Express building which the company has under construction at Sunnyside Yard, Long Island City, N. Y. The estimated cost is $200,000. A contract has been awarded to the Mead-Balch Construction Company, Indianapolis, Ind., for grading and masonry in connection with track elevation from Davidson street to Leota street, Indianapolis; total cost of work approximately $235,000.

The Quanah, Acme & Pacific has completed plans for the construction of an extension 27 miles long from MacBain, Tex., to Floydada, reported in the August issue. Application for permission to construct the extension is now pending before the Interstate Commerce Commission.

The Richmond, Fredericksburg & Potomac has awarded a contract to the Whiting-Turner Construction Company, Baltimore, Md., for the construction of a bridge over the Rappahannock river and the elevation of tracks through Fredericksburg, Va., at a total cost estimated at $1,000.000. This project was reported in the July issue.

The Southeastern has been denied by the Interstate Commerce Commission its application for authority to construct a line from a connection with the Southern at Bundy Station, Va., to a connection with the Louisville & Nashville at Louellen, Ky. (13.5 miles). The proposed line was projected to open up additional coal mining areas.

The Southern has awarded a contract for the construction of an office building at Charlotte, N. C., to the J. J. McDevitt Company. It will be constructed of reinforced concrete finished in stone and red brick. The work will start at once and be completed by October 1, 1926. Three bridges are to be built by this company on its line between Rome, Ga., and York, Ala., and five other bridge improvement projects are to be carried out immediately at points on the Mobile, Birmingham and Memphis divisions.

The St. Louis-San Francisco will carry out with company forces the rahabilitation of the Muscle Shoals, Birmingham & Pensacola, recently acquired, at a cost estimated at $2,500,000. In addition to improvements to the line, the terminal facilities at Pensacola will be considerably augmented. Location surveys are now being made in contemplation of the construction of a connection from the northern end of the Muscle Shoals line at Kimbrough, Ala., to the main line of the Frisco in the vicinity of Birmingham, a distance of approximately 150 miles. Two possible routes are understood to be under consideration.

The Union Pacific has awarded a contract to Peterson, Shirley & Gunther, Omaha, Neb., for the construction of the substructure and east approach of a 2,400-ft. steel and concrete bridge to be built at Omaha by the Union Pacific and the Union Stock Yards Company. The steel erection will be done by day labor. The total cost of the bridge is estimated at $360,000. A contract has been awarded to the Wheelwright Construction Company for the laying of an 8-inch cast iron pipe line 15 miles long from Carter, Wyo., to Leroy, to provide adequate water supply at the latter point. This company has applied to the Interstate Commerce Commission for a certificate authorizing the construction of a line of 10 miles southerly from a point near Yoder, Wyo.

Supply Trade News

General

The Sherwin Williams Company will construct a three-story addition to its plant at Chicago.

The Lundie Engineering Corporation will move its offices on January 15, from 920 Broadway to the Murray Hill building, 285 Madison avenue, corner of Fortieth street, New York City.

The Charles R. Long, Jr., Company, Louisville, Ky., has purchased a tract of land at Sixteenth and Hill streets, upon which it will construct a new paint and lacquer plant, to cost $450,000. The construction will be started immediately, the first unit to be four stories with basement, 70 ft. by 120 ft., and of reinforced concrete.

The Electrical Supply Business carried on by the Western Electric Company has been set apart from the telephone manufacturing business and incorporated under the name of **Graybar Electric Company.** Since it came into existence in 1869 as the partnership of Gray & Barton, the name which it now resumes in modified form, the supply business has grown steadily until it now has 55 distributing houses in important cities. The Western Electric Company has been both the manufacturing company of the Bell System and a distributor of electrical supplies. Both of these lines of business require specialized organization and specialized management.

Physical separation of the two departments of the Western Electric Company was carried out in 1923 with the opening of general offices for the Supply Department in the Pershing Square Building, New York. The advent of the Graybar Electric Company into this field as the successor to the Western Electric Company therefore involves few changes.

The officers of the company are: President, **Albert L. Salt** executive vice-president, **Frank A. Ketcham;** vice-president in charge of the sales, George E. Cullinan; vice president of merchandising and accounting, **Leo M. Dunn;** treasurer, **Elmer W. Shepard;** and secretary, **N. R. Frame.** The directors of the new company include the president, the three vice-presidents; **Charles G. Du Bois,** chairman, and the following executives of the Western Electric Company: **Richard H. Gregory,** controller; **Howard A. Halligan,** vice-president; **George C. Pratt,** general attorney, and **William P. Sidley,** general counsel. The capitalization of the Graybar Electric Company is $15,000,000, all of the stock being owned by the Western Electric Company.

Personal

W. J. Henry has been appointed district manager of the **Harnischfeger Corporation,** Milwaukee, Wis., with headquarters at Charlotte, N. C.

E. C. Chacey has been appointed sales representative in charge of the sales office at 350 Madison avenue, New York, of the **American Creosoting Company,** Louisville, Ky.

C. W. Damberg, formerly resident inspector of the New York, New Haven & Hartford, at New York, has been appointed railroad representative of the **A. M. Byers Company,** with headquarters in New York. **J. H. Ainsworth,** railroad representative at Pittsburgh, Pa., has been appointed director of railroad sales, with headquarters at Pittsburgh.

J. N. Walker has been appointed general sales manager of the **Oxweld Acetylene Company,** New York; **L. D. Bennett** has been appointed eastern department sales manager, to succeed Mr. Walker, and **Z. T. Davis, Jr., is now assistant sales** manager, eastern department.

Grant B. Shipley, consulting engineer, Pittsburgh, Pa., has been retained to design and supervise the construction of wood preserving plants to be built by the Kettle River Treating Company, Edwardsville, Ill.; W. P. Brown & Sons Lumber Co., Fayette, Ala.; Taylor-Colquitt Company, Spartanburg, S. C.; Great Northern, Somers, Mont., and the Detroit & Mackinac, East Tawas, Mich.

H. E. Anderson, district manager of **S. F. Bowser & Company, Inc.,** with headquarters at New York, has been promoted to manager of the northeastern division, with headquarters at Albany, N. Y., and will be succeeded by **E. M. Harshbarger,** manager of railroad sales, with headquarters at Fort Wayne, Ind. **G. J. Komarek,** chief sales correspondent in the lubrication and filtration division, with headquarters at Fort Wayne, Ind., has been promoted to district manager, with headquarters at Oklahoma City, Okla.

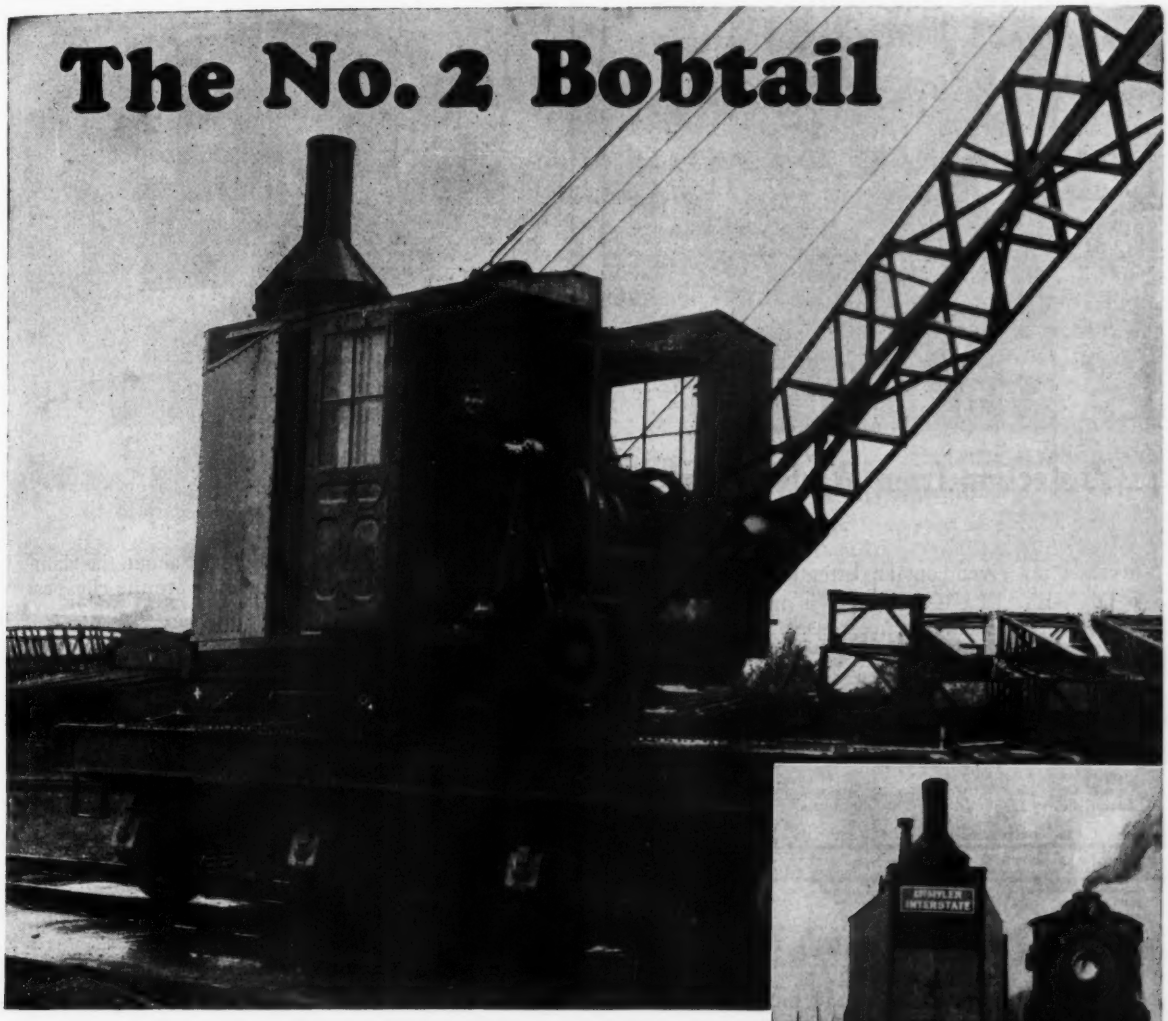
George D. Kirkham, sales agent of the American Steel & Wire Company, Chicago, will retire on December 31. Mr. Kirkham first came to the company as sales agent of the old Washburn & Moen Manufacturing Company, Worcester, Mass., in 1886. This company was taken over by the American Steel & Wire Company, 27 years ago. He served as an expert of the fine wire products of the company until 1902, when he was established as sales agent at Memphis, Tennessee, handling both merchant trade and manufacturing lines.

Charles L. Wood, who was appointed general manager of sales of the **Carnegie Steel Company,** Pittsburgh, Pa., as was announced in these columns of the December issue, was born in Youngstown, Ohio, on September 11, 1873. After attending the public schools of his native city he entered the Ohio State University at Columbus, where he took a course in mining engineering in the class of 1896. He entered the industrial field as a chemist with the Calumet Furnace Company in Chicago and later took up mining engineering in Colorado and other western districts. In 1898, Mr. Wood became affiliated with the American Steel Hoop Company and served as manager of the order department when it moved to New York. At the time this company was consolidated with the Carnegie Steel Company and with the formation of the United States Steel Corporation, Mr. Wood was transferred to the sales department of the Carnegie Steel Company. He served as assistant to William G. Clyde when the latter became assistant general manager of sales in that department and since 1918 Mr. Wood has been assistant general manager of sales in charge of the bar, hoop and band business of the Carnegie Steel Company.

Emmett Keough, assistant engineer maintenance of way of the Canadian Pacific, with headquarters at Montreal, Que., has resigned to become the Chicago representative of the Railway Appliances division of the American Fork & Hoe Company, with headquarters in the Railway Exchange building, Chicago, in the marketing of the "Stead" rail anchor. Mr. Keough was born at Danvers, Ill., on March 24, 1876, and entered railway service as a section laborer on the Jacksonville & Southeastern, now a part of the Chicago, Peoria & St. Louis, on May 1, 1892. He held this position until May 1, 1987, when he became a section foreman on the Camden branch of the St. Louis, Iron Mountain & Southern, now a part of the Missouri Pacific, later holding this same position on the Chicago & Alton. In 1903 he entered the University of Illinois, taking a preparatory course in civil engineering and graduating from the school of engineering of this university in 1908. During the summers he handled extra gangs on the St. Louis Southwestern on ballasting and high water work through Arkansas. He also served on the Chicago & Eastern Illinois and the Illinois Central, on various maintenance and rail renewal work. In 1907 he became general foreman on second track work on the Chicago, Burlington & Quincy at St. Joseph, Mo., and Kansas City, being promoted to roadmaster at Hannibal, Mo., in March, 1908. He was transferred to the Aurora division in 1910, where he remained as roadmaster and roadmaster-trainmaster until May, 1915, when he entered the employ of the Canadian Pacific as assistant engineer maintenance of way, Eastern lines, which position he was holding at the time of his resignation.

Emmett Keough

The No. 2 Bobtail



Does not tie up traffic

The No. 2 Bobtail does not tie up traffic on adjacent tracks. The amount of swing is controlled by adjustable stops which allow the operator to work with speed and safety. He knows that through traffic will clear.

This bobtail crane with ample room for operator and fireman and all mechanism easily accessible is an innovation. You will be interested in studying the floor plan of this crane. Shall we send it to you?

Steam Shovels • Gas Shovels • Locomotive Cranes • Clam-shell Buckets

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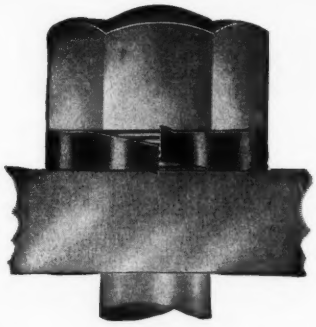

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Use Positives and forget to worry about the damage caused by vibration. Positives are the cheapest protection and the best.

Genuine KEYSTONE Positive and Plain Lock Washers made exclusively by

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with a RIFE HYDRAULIC RAM without fuel, labor, freezing or repairs. A small stream operates the Rife Hydraulic Ram and fills water tanks. Easy to install. No attention required. Used by over fifty railroads, among which are:

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Cuba Railroad Co.
Canadian National Railway
Sorocabana Ry. Co., Brazil.
Mexican R. R. Co.
Seaboard Air Line, Ga.
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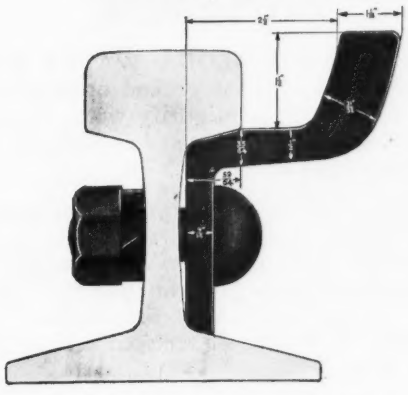
The American Railway Engineering Association voted approval of pumping water by means of hydraulic rams where they can be used, at the Convention which was held in Chicago March 10th to 12th.

Manufactured in nine sizes up to and including 12 inch, the largest Ram which can be successfully used under all conditions.

Write for catalogue complete on Rife Hydraulic Rams.

RIFE ENGINE COMPANY **1602 West Street Building, New York, N. Y.**

Rolled Guard Section 235 G



Rolled Guard Section 235 G is designed for use with standard tee rails on curves and in the manufacture of special trackwork. It has also found general use as a paving guard in paved streets, mill buildings, etc. The use of this guard insures a uniform flangeway for the wheel and protection to the abutting pavement.

Rolled Guard Section 235 G weighs 42 pounds per yard and is rolled to fit an 85 pound A.S.C.E. rail. It is also made to fit other sections.

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Gentlemen:
Put me down for one of your books "Shovel Troubles overcome."

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2. A design that makes overturning impossible.
3. A renewable Manganese steel face to insure long life.

"ACCO" One-piece Guard Rails combine these very desirable features. They require very little maintenance compared with frequent adjustments of ordinary types.

A single open-hearth casting combines all parts in one piece except the renewable Manganese steel face. Special lugs engaging the under side of the traffic rail prevent overturning.

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"ACCO" One-piece Rail Guard

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"ACCO" One-piece Guard Rails, "ACCO" Drop-Forged and "RESCO" Cast Steel Guard Rail Clamps, "SAMSON" Rail Benders, "READING" Reversible Rail Benders, Step Joints, Car and Engine Replacers.

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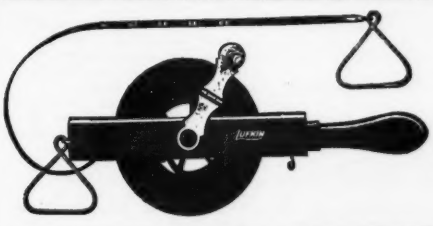

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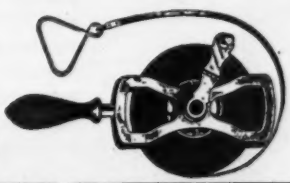

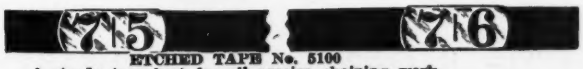

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½-gage mark when specified.

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Graduated on Babbitt Metal
Most popular for rough survey and maintenance work.
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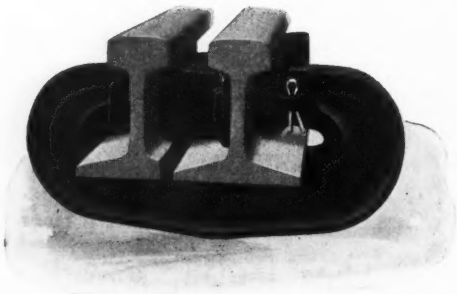

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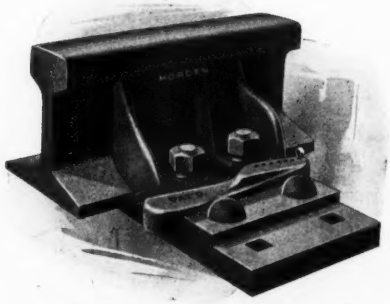
This clamp is GUARANTEED. A clamp that is not dependable is expensive at any price.

Made for rails from 80 to 130 lbs. per yd.



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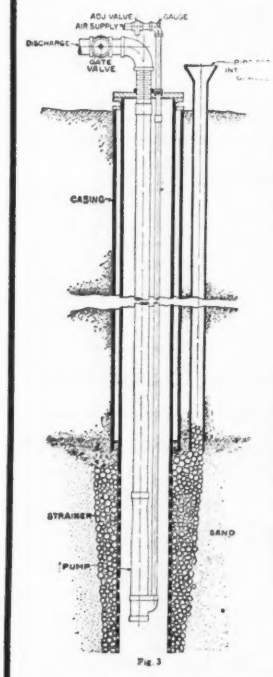

Fig. 3

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SULLIVAN AIR LIFT

The Sullivan method gets rid of sand and places a coarse gravel screen outside the strainer, permanently increasing the volume pumped, and preventing further "sanding in" trouble.

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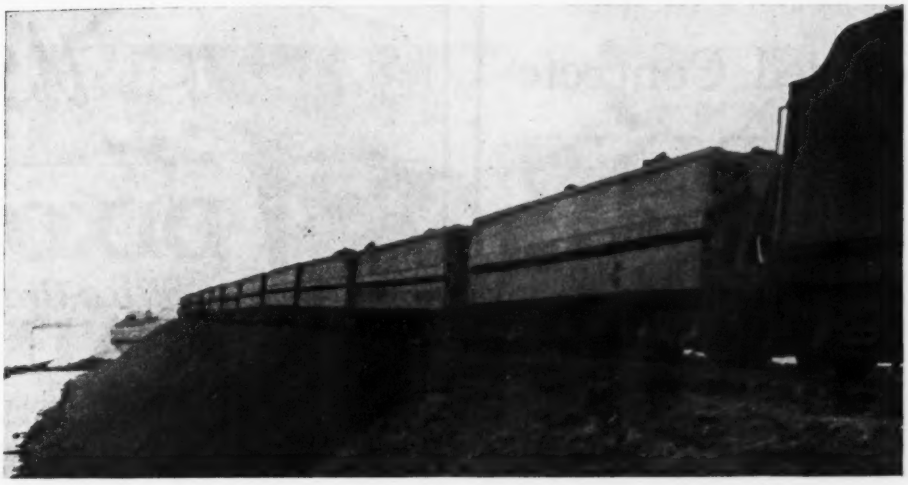

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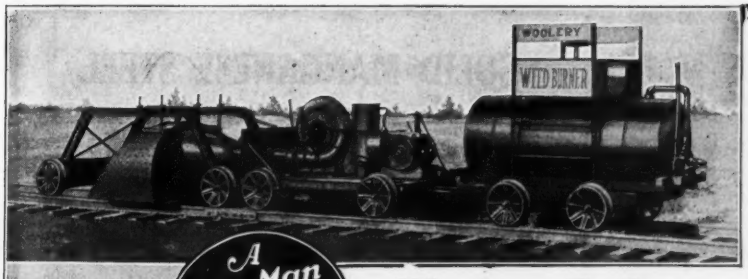
Combining special features such as the Magor Positive Compression locks, Magor quick lift door operating levers, Magor new design doors with extra wide opening, combined with most modern design in steel construction. Dumping cylinders operated by hand rods under end platform allowing operator to stand clear of track and dump on either side without preliminary adjustment. Standard equipment throughout to A. R. A. requirements. Ask for Catalog D.

MAGOR CAR CORPORATION **30 Church St.** **NEW YORK CITY**



A Two-Man Outfit of Guaranteed Efficiency
Average cost on first heavy burning less than $3.00 per mile

Note the clean, wide burned area that the Woolery leaves behind. In some places the weeds and quack grass had attained a height of 27 inches.

Woolery Railway Weed Burners

(Patent Applied For)

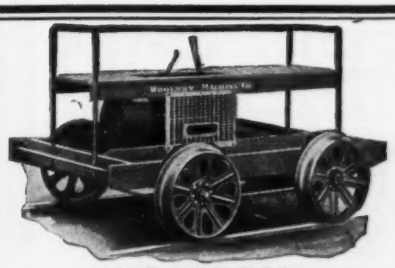
There is no question but that it has saved this company a great deal more than the price of the machine just in this season.
Signed by
Asst. Gen. Roadmaster of a prominent railroad

A Self-propelled, three-unit outfit operated by two men. Speed from 1 to 5 miles per hour for burning, and up to 20 miles an hour for traveling. Compared with large and cumbersome machines, the Woolery is light—quick—nimble. Being easy to handle and quick to fire it gets around and can be used in places and on short burnings where other machines would be impractical. It may be removed from track at highway crossings. Total length of outfit, about 34 feet.

Always Ready for a Demonstration on any Railroad

High Lights on the Woolery Weed Burner

- Burns Gas Oil, Distillate Oil or Kerosene, and fire starts instantly.
- ONE large Oil Burner—never whips out by tall weeds.
- Burns a strip 11 feet wide.
- Average burning rate, 2 miles per hour.
- Fire may be shut off when crossing bridges. No drip of oil.
- Fire relights automatically when fuel is turned on.
- Outfit carries supplies for a full day's operation.
- Any speed from 1 to 20 miles per hour on its own power.
- All steel construction—safe and dependable.
- Four-Wheel Drive and Four-Wheel Brake—ample traction and safety.
- Chrome Nickel Steel Ball-Bearing Axles—Strong and Easy-Running.

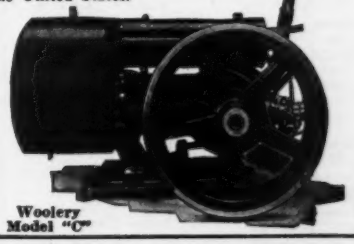


WOOLERY

Railway Motor Cars and Motor Car Engines

Woolery Truss-Frame Railway Motor Cars, while of light weight, possess extraordinary strength. When equipped with our new 2-speed transmission and powered with either the Woolery Model "C" (9 h.p.) or the Model "CC" (18 h.p.) engine, it is a universal car that meets all-around requirements.

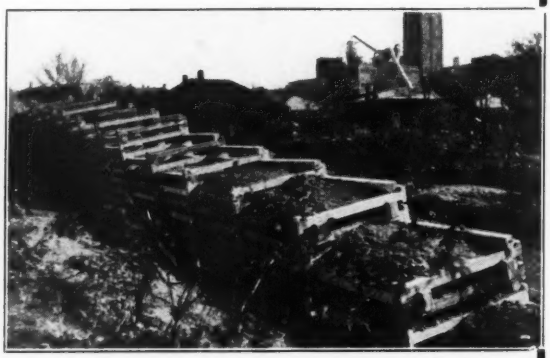
Because of their lighter weight, greater power, and less cost per horse power, Woolery Reversible, Ball Bearing, Motor Car Engines have been adopted as standard equipment on some of the largest railroads in the United States.



Woolery Model "C"

WOOLERY MACHINE CO. *Write for Prices and Further Information* **Minneapolis, Minn.**

Reinforced Concrete CRIBBING



WHEN filled with earth, a Massey Cribbing Wall has the same stability against overturning as a solid wall of equal thickness. It has the same permanence too. The concrete is of higher quality than the ordinary monolithic construction because it is built under ideal conditions in plants that are specially equipped and manned for the purpose.

But a Massey Cribbing Wall costs much less than monolithic construction—not only because less concrete is used, but also because the labor involved is reduced to a minimum. This and other advantages such as the elimination of handling equipment, the ease of delivery on the job, the ease with which it can be removed or added to, etc., are rapidly bringing this type of crib wall into general use.

Have you a copy of our Catalog Supplement No. 20?

MASSEY CONCRETE PRODUCTS CORP.

Canadian Concrete Prod. Co., Ltd.

Peoples Gas Bldg. Chicago — *Transportation Bldg. Montreal*

Sales Offices

New York 50 Church St.
Atlanta Candler Building
Cincinnati 528 Dixie Terminal Building
St. Louis Railway Exchange
San Francisco 1101 Matson Bldg.
Los Angeles 390 Pacific Electric Building

Plants Located at

Clearing (Chicago), Ill.
Colton, Calif.
Dallas, Texas
Kansas City, Kan.
Melbourne, Ky. (Cincinnati)
Memphis, Tenn.
Minneapolis, Minn.
Montgomery, Ala.
Newark, N. J.
Belleville, Ont.
Chatham, Ont.
Salt Lake City, Utah
Spokane, Wash.

Other Products

Use DIXON'S *Silica-Graphite* PAINT

For the economical protection of all exposed metal or wood work.

Judge paint by the years of service obtainable and not by the cost per gallon.

Dixon's Paint is known as the long service paint. Records of from five to ten years are obtainable due to its wear-resisting pigment, flake silica-graphite.

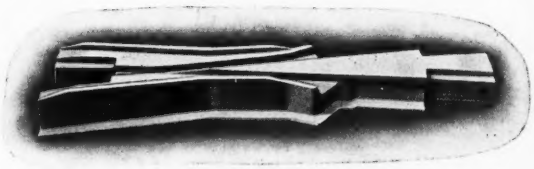
Write now for Booklet 187-B, and learn how you may reduce your paint costs.

Joseph Dixon Crucible Co.

Established 1827

Jersey City, N. J.

SOLID MANGANESE STEEL



SELF-GUARDED FROG

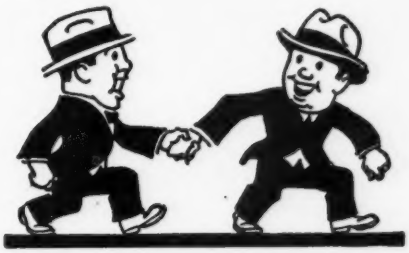
Combines in one casting the functions of an ordinary frog and two guard rails at no greater cost.

Wm. Wharton Jr. & Co., Inc.

Easton, Pa.

Sales Offices

Boston, Mass.
Chicago, Ill.
El Paso, Tex.
Montreal, Can.
New York, N. Y.
Philadelphia, Pa.
Pittsburgh, Pa.
Salt Lake City, Utah
San Francisco, Cal.
Scranton, Pa.



Hand in Hand advertising and lower sales cost

It is to the buyer's interest to know that goods are *sold economically* for he pays the cost of selling just as he pays for the cost of manufacturing.

That's why more and more buyers are scrutinizing sales methods of manufacturers, for they know that excessive sales costs mean either higher prices or shrinking quality.

The seller who clings to antiquated, expensive methods of selling is no more entitled to patronage than one who runs an out-of-date factory.

Machinery has cut costs and standardized products in manufacturing and the *machinery of advertising* is accomplishing similar benefits in selling, for advertising in publications such as this one, is not an added expense, but an improved means of communication that takes the place of slower and more costly methods.

These are demonstrated facts and thinking buyers are recognizing the advantage to them of encouraging progressive, economical *sales* methods, such as have been adopted by the companies represented in the advertising pages of this journal.

The advertising these companies are doing not only cuts the cost of selling, but it increases production volume, standardizes quality, and is a guarantee of good faith.

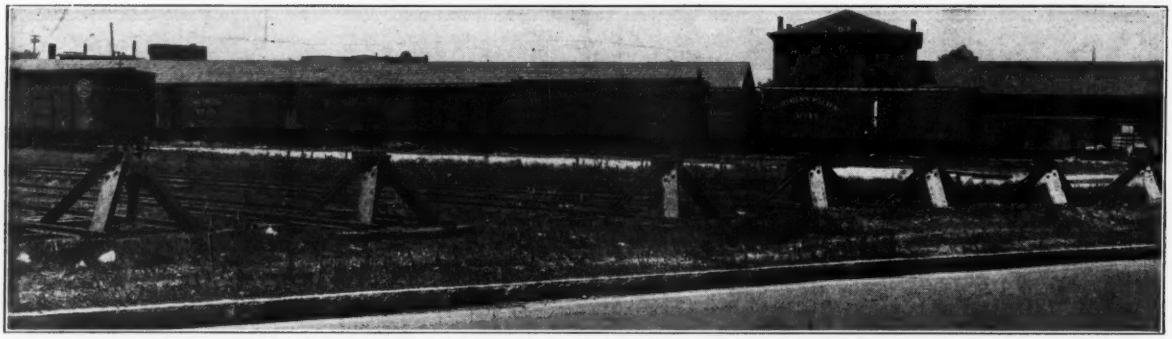
Write us about anything you desire to know about business papers or the fields they cover.

The
ASSOCIATED BUSINESS PAPERS, INC.
Headquarters, 220 West 42nd Street, New York City
Over 120 Publications Reaching 54 Different Fields of Trade and Industry

A.B.P.

"Member of The Associated Business Papers, Inc." means proven circulations PLUS the highest standards in all other departments.

This publication is a member of the A. B. P.



The Locomotive Has Its Emergency Brake, the Stub End Track Has Its "Durable"

Conditions may arise at any time in the operation of a train when an immediate stop is essential. The emergency brake is provided for such occasions.

A condition always exists at the end of a stub track requiring an immediate stop. The Durable Bumping Post installed at all such locations will enforce this requirement.

Like the emergency brake, the Durable may not often be called into action, but it is just as essential to have it on guard.

This safety is available through the use of the Durable Bumping Post at a nominal cost. Its simple construction makes installation easy and maintainance expense negligible.

MECHANICAL MANUFACTURING COMPANY

Also Manufacturers of the Ellis Bumping Post

Pershing Road and Loomis Street **Chicago, Illinois**

MURDOCK WATER SERVICE

MURDOCK WATER SERVICE BOX
For Coach Yards, Train Sheds — Cinder Pits—Saves Water and Maintenance.

FOOL PROOF DRINKING FOUNTAINS

Murdock Outdoor Bubble Font—
Anti-freezing for Yards and Train Sheds.

Unbreakable Pedestal Fountains
with solid bronze bowls and bubbler heads for shops and stations.

All Brass Wall Fountains
for depots.

Solid Brass Bubbler Heads.

HYDRANTS
Self-closing and Compression Types.
Also Fire Hydrants.

Write for complete catalogues

The Murdock Mfg. & Supply Co.
Cincinnati, Ohio

Kilby Frog & Switch Co.
Birmingham, Ala.

Manufacturers of

Railroad Crossings, Frogs and Switches

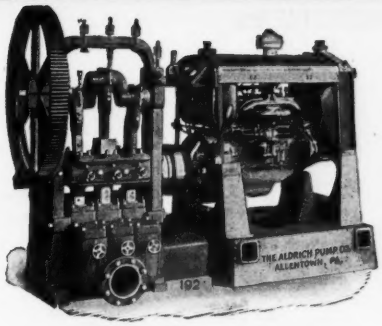
Manganese Track Work a Specialty

Balkwill Cast Manganese Articulated Crossings

Graham Flange Frogs

(The Savers of Maintenance)

ALDRICH



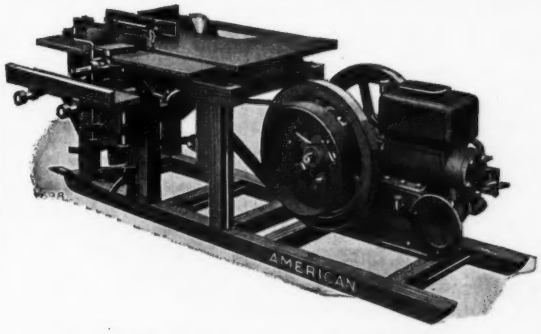
FOR ISOLATED POINTS
WHERE ELECTRIC CURRENT
IS NOT AVAILABLE

THE ALDRICH PUMP CO.
ALLENTOWN, PENNA.

VERTICAL GENERAL SERVICE TRIPLEX
HORIZONTAL HIGH PRESSURE QUINTUPLEX

PUMPS

AMERICAN COST CUTTERS



Portable Woodworking Machinery for use on the job.

Saw Mills, Woodworkers, Planers, Jointers, Band Saws, Re-saws, Cut-off Saws.

Ask for Complete Catalog

American Saw Mill Machinery Co.
164 Main Street Hackettstown, N. J.

WOULD you reduce track maintenance costs? Would you make track lining easier for your section crews? Then investigate the Bloxham Track Liner. It enables three men to do the work of from eight to eleven equipped with old time lining bars. A pull, with the weight of the body to help, takes the place of a dead lift. Write for complete information.

Chicago Steel Foundry Co.
Kedzie Ave. & 37th Street, Chicago

W. R. McDonough & Co., National Building, Cleveland, Ohio

Hubbell & Sharp, 1216 Chemical Building, St. Louis, Missouri

J. J. CRAWFORD, Stahlman Building, Nashville, Tenn.

W. R. McDonough & Co., General Motors Bldg., Detroit, Mich.

BLOXHAM
Track Liners

RE&M1—I—RTG

Buyers' Guide

CLASSIFIED INDEX TO ADVERTISERS

Acetylene, Dissolved.
Oxweld Railroad Service Co.

Air Compressors.
Fairbanks, Morse & Co.
Gardner Governor Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Air Hoists.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Air Lift Pumping Machinery.
Gardner Governor Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

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Anti-Creepers, Rail.
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P. & M. Co.

Ash Conveyors
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Barber Asphalt Co.

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Rodger Ballast Car Co.
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Mudge & Co.
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Hyatt Roller Bearing Co.

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Dickey Clay Mfg. Co., W. S.

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Owen Bucket Co.

Building Beams, Concrete.
R. C. Products Co., Inc.

Building Papers.
Barber Asphalt Co.

Bumping Posts.
Buda Co.
Louisville Frog & Switch Co.
Mechanical Manufacturing Co.

Calcium Carbide
Oxweld Railroad Service Co.

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Cars, Dump.
See Dump Cars.

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Mudge & Co.
Northwestern Motor Co.

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Woolery Machine Co.

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Mudge & Co.
Northwestern Motor Co.
Woolery Machine Co.

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Mudge & Co.
Northwestern Motor Co.
Woolery Machine Co.

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Fairbanks, Morse & Co.

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Industrial Works.

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Fairbanks, Morse & Co.

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McMyler Interstate Co.

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Mudge & Co.
Northwestern Motor Co.
Woolery Machine Co.

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Mudge & Co.
Northwestern Motor Co.
Woolery Machine Co.

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Graders, Elevating.
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Grading Machinery.
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Kilby Frog & Switch Co.
Morden Frog & Crossing Works
Ramapo Ajax Corp.
Wharton, Jr., & Co., Inc., Wm.

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Sullivan Machinery Co.

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Sullivan Machinery Co.

Hammers, Riveting.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Verona Tool Works.

Hammers, Steam.
Industrial Works.

Heaters, Feed Water.
American Water Softener Co.

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Fairbanks, Morse & Co.
McMyler Interstate Co.

Hose.
Ingersoll-Rand Co.

House Lining.
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Bethlehem Steel Co.
Rail Joint Co.

Insulating Material.
Barber Asphalt Co.

Interlocking Switchstands.
American Valve & Meter Co.

Jacks, Bridge.
Buda Co.

Jacks, Track.
Buda Co.
Hackmann Railway Supply Co.
Verona Tool Works.

Joints, Compromise.
American Chain Co., Inc.
Bethlehem Steel Co.
Morden Frog & Crossing Works
Rail Joint Co.

Joints, Rail.
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Fairmont Railway Motors, Inc.

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National Lock Washer Co.
Positive Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works.

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Bethlehem Steel Co.

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Massey Concrete Products Corp.

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Paint.
Dixon Crucible Co., Jos.

Paint, Metal Protecting.
Barber Asphalt Co.
Dixon Crucible Co., Jos.

Pavement Breakers.
Ingersoll-Rand Co.
Sullivan Machinery Co.

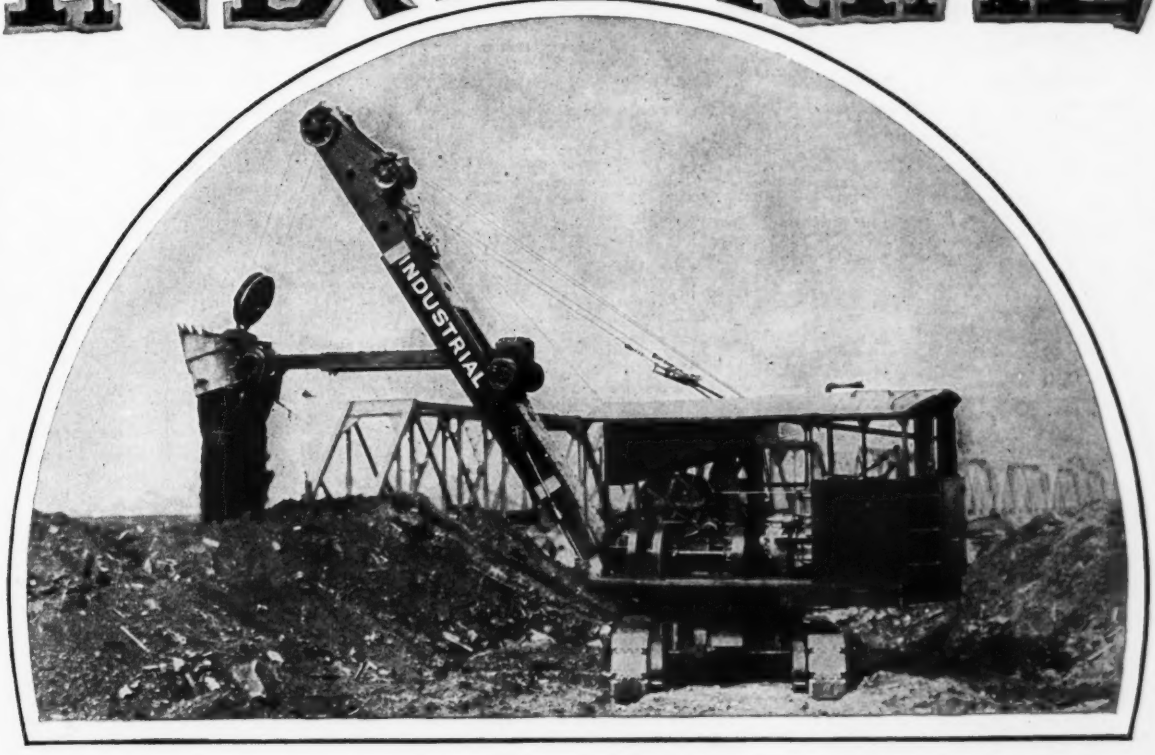
Penstocks.
American Valve & Meter Co.
Fairbanks, Morse & Co.

Pile Drivers.
Industrial Works.
McMyler-Interstate Co.

Piling.
International Creosoting & Constructing Co.
Massey Concrete Products Corp.

Pipe Carriers.
Massey Concrete Products Corp.

INDUSTRIAL



DO YOU KNOW THE WINNING FEATURES?

EFFECTIVE and economical operation requires both speed and the great strength necessary for continuous operation. The INDUSTRIAL WORKS has given thorough study to the conditions under which these machines must operate and has designed them with high speed and of greater strength and reliability than any other machine of this class on the market.

The type DC shown above exemplifies the results attained in the production of material handling machinery, which, on account of its power, strength and efficiency will accomplish the work demanded of it, with the highest economy in the shortest time.

The winning features of the INDUSTRIAL type DC, and those which make possible its splendid achievements, are—extra large rollers in the crawling treads which hold the bearings high up out of the dirt; two speeds for traveling and hoisting; steering and propelling controlled entirely from operator's platform; independent friction clutches for each function; steel castings, bronze bushings; cut gears, and a host of other outstanding superiorities.

The DC is a crane, shovel, dragline, piledriver, clamshell, grapple, magnet, all in one, and it gives maximum efficiency in each service. Start the New Year right by specifying INDUSTRIAL equipment.

Book 120-A will be sent to you promptly upon request.

INDUSTRIAL WORKS · BAY CITY · MICHIGAN

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Pipe, Cast Iron.
American Casting Co.
Cast Iron Pipe Publicity Bureau.
U. S. Cast Iron Pipe & Foundry Co.

Pipe, Concrete.
Massey Concrete Products Corp.

Pipe, Corrugated.
Armco Culvert & Flume Mfrs. Assn.

Pipe, Sewer.
American Casting Co.
Dickey Clay Mfg. Co., W. S.
Massey Concrete Products Corp.

Pipe Joint Compound.
Dixon Crucible Co., Jos.

Plows, Railroad.
Western Wheeled Scraper Co.

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International Creosoting & Construction Co.
Massey Concrete Products Corp.

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See Bumping Posts.

Posts, Fence.
See Fence Posts.

Power Plants, Portable
Electric Tamper & Equipment Co.

Preservation, Timber.
International Creosoting & Construction Co.

Products, Gas.
Oxweld Railroad Service Co.

Pumping Engines.
Rife Engine Co.

Pumping Stations
Fairbanks, Morse & Co.

Pumps, Air Pressure and Vacuum, Centrifugal, Deep Well, Piston, Plunger, Rotary, Slump.
Aldrich Pump Co.
Fairbanks, Morse & Co.
Gardner Governor Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Push & Hand Car Bearings.
Hyatt Roller Bearing Co.

Push Cars.
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Buda Co.
Morden Frog & Crossing Works
Ramapo-Ajax Corp.
Wharton, Jr., & Co., Inc., Wm.

Rail Joints.
See Joint, Rail.

Rail Saws, Portable.
Industrial Works.

Rail Springs.
Verona Tool Works.

Removers, Paint.
Mudge & Co.

Rams, Hydraulic.
Rife Engine Co.

Replacers, Car
American Chain Co., Inc.
Buda Co.

Rivets.
Bethlehem Steel Co.

Roller Bearings.
Hyatt Roller Bearing Co.

Roof Slabs.
Massey Concrete Products Corp.

Roofing Composition.
Barber Asphalt Co.

Rules.
Lufkin Rule Co.

Saw Mills.
American Saw Mill Machinery Co.

Saws, High Speed Friction.
American Saw Mill Machinery Co.

Saw Rigs.
American Saw Mill Machinery Co.
Fairbanks, Morse & Co.

Scales.
Fairbanks, Morse & Co.
Lufkin Rule Co.

Scrapers, Wheel, Drag and Buck.
Western Wheeled Scraper Co.

Screw Spike Drivers.
Ingersoll-Rand Co.

Section Cars.
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Sheathing, Paper
Barber Asphalt Co.

Sheet Iron.
Armco Culvert & Flume Mfrs. Assn.

Shingles, Composition.
Barber Asphalt Co.

Signal Foundations, Concrete.
Massey Concrete Products Corp.

Skid Shoes
Q. & C. Co.

Slabs, Concrete.
Massey Concrete Products Corp.

Smoke Stacks.
Chicago Bridge & Iron Works.
Massey Concrete Products Corp.

Snow Plows
Jordan Co., O. F.

Special Track Work
Morden Frog & Crossing Works

Spikes.
Bethlehem Steel Co.

Spreader Cars.
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Spreaders, Ballast.
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Standpipes.
Chicago Bridge & Iron Works.

Standpipes, (Penstock).
American Valve & Meter Co.
Fairbanks, Morse & Co.

Stands, Switch & Target.
Bethlehem Steel Co.
Ramapo-Ajax Corp.

Station Houses.
Massey Concrete Products Corp.

Step Joints.
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Switch Locks.
American Valve & Meter Co.

Switch Interlocker.
American Valve & Meter Co.

Switches.
Bethlehem Steel Co.
Buda Co.
Frog Switch & Mfg. Co.
Kilby Frog & Switch Co.
Louisville Frog & Switch Co.
Morden Frog & Crossing Works
Ramapo Ajax Corp.
Wharton, Jr., & Co., Inc., Wm.

Switchmen's Houses.
Massey Concrete Products Corp.

Switchstands & Fixtures.
American Valve & Meter Co.
Bethlehem Steel Co.
Buda Co.
Morden Frog & Crossing Works
Ramapo Ajax Corp.

Structural Steel.
Bethlehem Steel Co.

Tampers, Tie.
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Tank Fixtures.
Fairbanks, Morse & Co.

Tanks, Elevated, Steel.
Chicago Bridge & Iron Works.

Tanks, Oil Storage.
Chicago Bridge & Iron Works.

Tank Valves.
American Valve & Meter Co.

Tanks, Water Storage.
Chicago Bridge & Iron Works.
Fairbanks, Morse & Co.

Tapes.
Lufkin Rule Co.

Tee Rails.
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Telegraph Poles.
See Poles.

Ties.
International Creosoting & Construction Co.

Tie Plates.
Bethlehem Steel Co.
Lundie Engineering Corp.

Tie Rods.
Bethlehem Steel Co.

Tie Spacers
American Chain Co., Inc.
Co.

Tie Tampers.
Electric Tamper & Equipment Co.
Ingersoll-Rand Co.

Tile, Clay.
Dickey Clay Mfg. Co., W. S.

Timber, Creosoted.
International Creosoting & Construction Co.

Tools, Pneumatic.
Ingersoll-Rand Co.

Tools, Track.
Buda Co.
Hackmann Railway Supply Co.
Verona Tool Works.

Tools, Wrecking.
Industrial Works.

Tongue Switches.
Bethlehem Steel Co.
Buda Co.
Frog Switch & Mfg. Co.
Kilby Frog & Switch Co.
Ramapo Ajax Corp.

Torches, Oxy-Acetylene Cutting & Welding.
Oxweld Railroad Service Co.

Track Drills.
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Track Jacks.
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Track Liners.
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Track, Portable.
Western Wheeled Scraper Co.

Track Scales
Fairbanks, Morse & Co.

Track Tools.
See Tools, Track.

Transfer Tables.
Industrial Works.

Treating Plants, Water.
American Water Softener Co.

Trestle Slabs.
Massey Concrete Products Corp.

Turntables
McMyler-Interstate Co.

Water Columns.
American Valve & Meter Co.
Fairbanks, Morse & Co.

Water Cranes.
American Valve & Meter Co.
Fairbanks, Morse & Co.

Water Softening Plants.
American Water Softener Co.
Chicago Bridge & Iron Works.

Water Treating Plants.
American Water Softener Co.
Chicago Bridge & Iron Works.

Water Tanks.
Chicago Bridge & Iron Works.

Water Treating Tanks.
Chicago Bridge & Iron Works

Waterproofing Fabrics
Barber Asphalt Co.

Weed Burner.
Woolery Machine Co.

Welding, Oxy-Acetylene.
Oxweld Railroad Service Co.

Welding & Cutting Equipment.
Oxweld Railroad Service Co.

Wheels, Hand & Motor Car.
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Mudge & Co.
Northwestern Motor Co.
Woolery Machine Co.

Windshields.
Fairbanks, Morse & Co.

Wood Grapples.
Industrial Works.

Wood Preservation.
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Woodworking Machinery.
American Saw Mill Machinery Co.

Wrecking Cranes.
Industrial Cranes.

ALPHABETICAL INDEX TO ADVERTISEMENTS

IMPROVED HIPOWER

REDUCE
Maintenance Costs

IMPROVED HIPOWER forces the joint bars into their proper places and therefore assures tight joints at all times.

This continuous security prevents bolt breakage, eliminates battering of rail ends and malformation of angle bars and minimizes the cost of retightening track joints—all of which are big items in maintenance costs.

The National Lock Washer Co.
Newark, N. J., U. S. A.

How they hold!

Ericson Rail Anchors hold to the rail and do not move from their original positions.

That means that they will not move along the rail, be loosened by frozen ballast, or chatter loose from vibration. Before an Ericson anchor will move along the rail, it will force the tie right through the ballast.

The Ericson is made in *two pieces*—a malleable iron shoe that grips the rail with a driving fit, and a steel yoke that holds the shoe perpetually in place. More than two million of these anchors are in use and have demonstrated conclusively their unfailing ability to stop rail creeping.

A leaflet, just off the press, tells the complete story of this anchor—what it is, what it does, how it does it, how it is made, and how it is applied. It will gladly be sent to any railroad official or employee. If you have not received a copy, write for one.

Read the Verona advertisements in the colored insert which appears in this issue.

VERONA TOOL WORKS

Pittsburgh New York Chicago Boston St. Louis San Francisco
New Orleans Washington St. Paul Denver Baltimore